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Journal of Educational Research

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Editor-in-Chief, B. R. Buckingham
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JOURNAL *of* EDUCATIONAL RESEARCH

Volume XI JANUARY, 1925 Number 1

THE IMPROVEMENT OF MENTAL MEASUREMENTS

EDWARD L. THORNDIKE
Teachers College, Columbia University

Twenty-five years ago there were no measurements of the educational achievements of pupils save the "marks" or "grades" which expressed teachers' opinions in numbers, letters, or cabalistic signs. The psychologists had just begun to apply their methods of measuring perception, memory, reaction time, speed and accuracy of movement, and the like, to the study of individuals on a wide scale. A common view among teachers then, and for some time thereafter, was that you could not apply the methods of quantitative science to education. The mind of the child was alleged to be too ethereal and spiritual and unapproachable to be surveyed and charted. Equally common was the view that, if you could do so, it would be a mischievous and brutalizing procedure, which would replace loving care and sympathy by heartless codes and statistics.

These attitudes are fast disappearing. The former has been proved wrong by the potent logic of fact. Each year some new aspect of educational work submits to more or less scientific measurement. The second rested on the fallacy of assuming that what certain persons would do only in cold blood and at the cost of humaneness, would needs be so done by others. Fortunately, teachers may love their pupils as much if they give them a Stanford Achievement Test as if they give them an examination which their grandmothers made. I can remember when a certain woman was viewed with alarm and suspicion by her neighbors as one devoid of all proper maternal feeling, because she weighed

her children every week. Now it is the mothers who do not weigh their children, who are the hard of heart.

Seldom indeed has there been so rapid an acceptance of scientific procedure in any sphere of practical human activity as the acceptance by teachers of the units and sales of measurement of intellect and intellectual achievements which the sciences of psychology and education have devised in the past score of years. The time seems near at hand when Binet and Terman will be household words like Royal Baking Powder or Ivory Soap, and when parents will be asked, "Has you child been 'Bineted'?" as nonchalantly as, "Has he been vaccinated?" This welcome has been earned. The scales and tests, at least those which have been devised by men and women of first-rate scientific ability, have been much better than that which they replaced. Abundant proof could be given that, on the whole, they have changed school work for the better. We may rightly hope, that more and more such instruments of measurement will be made, and that the good ones already made will be more and more widely used.

The extension of measurement in education, however, does not on the whole, seem to me to be as important as its improvement. I have a much greater concern about making our measurements better—more exact and more significant—than by extending their use, either in respect to the abilities covered or the individuals measured by them.

We can indeed, in a certain sense, phrase the entire process of advance in mental measurement as a process of measuring the same things better. Twenty-five years ago they measured much the same things that we measure now, and made probably even more measurements of them than we do. Teachers then often marked each pupil from 1 to 10 on each recitation of each day, so that a single teacher in a year might make and record twenty or thirty thousand formal measurements. Gossip about the abilities, achievements, and traits of character of a person is essentially a series of measurements of him. It will be many years before the number of persons whose characters are measured by the psychologists using the Voelker or Cady tests

or the Upton-Chassell Conduct Scale, will be a one-thousandth as many as the number whose characters are measured by friends and enemies in adjectives! The opinions recorded in teachers' marks and in conversations about persons, differed from our present test scores chiefly by being less exact and less significant measures of the facts they purported to present.

In discussing means of improving our measurements, I shall in the main restrict the facts and illustrations to the case of measuring intellect. The principles will apply, however, to the measurement of all, or nearly all, of the abilities of man.

Existing instruments for measuring intellect are vastly better than those available a generation ago, but they are not yet free from two serious defects. First, the units of measure are arbitrary, so that we do not know how far we have a right to treat the scores as numbers and to add, subtract, multiply, divide, and compute ratios with them. Second, we do not know how much of intellect these scores measure and how much they are contaminated by factors outside intellect.

Arbitrariness of Units

The score derived from our present instruments is a number representing a summing of credits, or credits and penalties. This number cannot be taken at its face value. If three persons A, B, C, score respectively 50, 75, and 100 on army alpha, we cannot infer that C is as far above B in whatever ability army alpha measures, as B is above A. Still less can we infer that C has twice as much of this ability as A has. If X, Y, and Z score respectively mental ages four, six, and eight by the Stanford Binet, we cannot infer that Y equals the average of X and Z in the ability measured by the Stanford Binet. Still less can we infer that X has only half as much of that ability as Z has. For all that we know, the step from 100 to 102 in army-alpha score may represent two times or three times or ten times as much real difference in intellect as the step from 1 to 2, and only one-half or one-third as much as the step from 201 to 202. For all

that we know, the step from Stanford mental age of 4 to that of 6 may represent more or less than the step 6 to 8.

The scores obtained by even our best instruments are all more or less arbitrary summations of units of unknown value. The case is much as if we measured the food value of what a person ate in a day by counting one for each slice of bread, each glass of milk, each ounce of meat, each pat of butter, each ounce of lettuce, and the like. Such a system of food credits would rank persons roughly as to the amount which they ate, but it would not *measure* them, because the different things rated one are not proved to be equal.

One chief task in improving measurements of intellect is then to find the real value of each step upward in the scores, and so to transform them into members where the series 1, 2, 3, 4, 5, etc. will represent amounts of ability increasing by truly equal steps.

It may be objected that for practical purposes a measurement in terms of the age at which the given score is attained on the average is satisfactory. "As able in intellect as the average ten-year-old," "as able in reading as the average eleven-year-old," and other similar "ages," may seem to be more useful at present than absolute scales in truly equal units. Up to the age of thirteen or fourteen the "mental ages," "arithmetic ages," "reading ages," and the like, are convenient, intelligible, and realistic, but for larger amounts of the abilities they are not. They are not convenient, because the computation of quotients becomes difficult, and because we need to state abilities far above those of the average eighteen-year-old or twenty-eight-year-old or fifty-eight-year-old. They are not readily intelligible, because we have to change from age to something else, or make up purely imaginary "mental ages" sixteen, eighteen, which are far above the status of the average person of sixteen, eighteen, or twenty-eight. They are not realistic, because we know very little of what the intellect of the average person at sixteen or eighteen or twenty or twenty-eight is, so little that, for example, we do not even know whether or not he improves from fourteen to twenty-eight.

The age measurements have done and are doing admirable service; but if we had a scale for intellect such as we have for

height and weight, we would no more score a child as "mental age, 124 months" than we would score him "height age, 124 months" or "weight age, 124 months."

Ambiguity in Significance

There seems to be a widespread opinion that intellect is a unitary something like blood pressure or weight or wealth or longevity or electrical conductivity, and that with sufficient ingenuity we may hope to discover some simple and convenient measure of its amount. According to this view, intellect is a faculty or power of essence which reveals itself more or less well in solving arithmetical problems, or giving opposites, or completing sentences, and which may be expected to reveal itself perfectly when we find still better tests than these. It is there hiding, as it were, requiring only a better net or trap to catch and weigh it. By this view we should improve our measures by trying various promising symptoms until we find those which are essential, or even a single one which will be adequate by itself.

In some ways this is all reasonable and stimulating, and I am myself engaged in the search for a simple explanation of intellect and for some one symptom that may be its sign and measure. In other ways, however, this view may retard progress by preventing us from facing all the facts and by leading us to attempt researches without suitable preparation. It should, therefore, be combined with a full realization that at present we measure only responses to certain tasks which psychologists have found to be more or less symptomatic of intellect as shown by success in school, nonconfinement as an imbecile, ratings by one's teachers or fellow pupils, and the like. When we say that a man is found by measurement with army alpha to have the intellect of an average recruit in the draft, or of an average boy of 160 months, all that we really know is that the man does as well in that particular sampling of tasks as the average recruit or boy of 160 months did. We do not know how much of intellect army alpha measures, and how much it fails to measure.

An important step in improving our measurements of intelligence seems to me to be to recognize that we always measure a person's intelligence by the intellectual products which he produces and the ways he takes to produce them, and that these products are numerous and varied. There are literally millions of different intellectual tasks; different in the sense that success with any one of them would not necessarily and always imply success with any other. Any intelligence test is a sampling from these tasks. Some tasks have been found to be especially indicative and prophetic of general intellectual ability, and form the components of such present tests as the Stanford Binet, the National, the Otis, and the like. Among such tasks, especially symptomatic and prophetic of general intelligence, are solving arithmetical problems, defining words, giving opposites or synonyms, supplying omitted words in sentences, supplying omitted parts of pictures, supplying a fourth term in series like

oyster, shell; banana.....(peel)
1.....10,.....100,.....(1,000)
professor, professorship; sheriff,.....(shrievalty)

and understanding and remembering sentences so as to follow directions stated or printed. These are of great value. Terman, for example, has shown that fifteen minutes given up to definitions of a hundred graded words probably provides a better measure of a ten-year-old's intellectual status than his own parents have gained from their years of intimate experience. But no dozen problems, no hundred words, no score of sentences give a complete measure of intellect. The sampling must be much wider, if we wish to obtain a rating which will be at all exactly proportional to the amount of intelligence of the person rated. We can improve our measures at once by increasing the quantity or the variety, or both the quantity and the variety of the sample tasks.

Our tests are also diluted or contaminated by the influence of other things than intelligence, such, perhaps, as speed of writing or effort to do one's best, or excitement and worry caused by the

examination, or special circumstances of training. The ideal should be to sample all of intellect and nothing but intellect.

Suppose that this improvement has been accomplished—that we have an examination composed of, say, a thousand tasks which represent a fair sampling of intellectual production, with as little admixture of anything else than intellect as is practicable. Such an examination is a sampling from all possible tasks for intellect. These vary greatly in intellectual difficulty. Some of them could be done correctly by only the greatest intellects, say by the five percent nearest to the Aristotle—Galileo group. Some could be done by the highest ten percent. Some could be done by the highest fifteen percent.[1] At the other extreme would be some that could be done by ninety-five percent of five-year-old children.

Intellectual tasks may then be arranged in tiers or levels according to their difficulty. If a person were tested with all of them, we should have a record of how many he succeeded with at each level, how quickly he did each, and—so far as methods of observing him are available—of how he did each.

Two individuals would differ in respect to the difficulty of the tasks they could do, in respect to the number of tasks of any assigned degree of difficulty they could do, in respect to the speed with which they could do tasks which they both could do, and in respect to the methods which they used in doing these tasks. Each of these qualities may vary independently of the others, though in actual fact they are usually somewhat closely associated. All are indicative of intellect. Let us call them the level or height of intellect, the range or width of intellect, the speed or facility of intellect, and the method or technique of intellect.

[1] There would, of course, be overlapping of groups for any one task, it being occasionally missed by some persons abler than those who, in general, just could do such tasks and mastered by some persons less able than those who in general could do such tasks. In this and what follows the limitations of space will require me to write loosely, superficially, and dogmatically. A more rigorous, thorough, and critical treatment of the matters presented here will appear soon in a monograph on the "Measurement of Intelligence."

By our present methods, we combine these four qualities into a single estimate of intelligence, largely by guess-work. We compute one single score by some system of credits. The level, range, speed, and to some extent the method of a person's intellect share in determining his score. Each has some influence, but we do not know how much. The same score might be attained by two persons of whom one did all of the easiest half of the tasks, while the other did half of the easier and also half of the harder tasks. We cannot tell what a score means in terms of intellectual tasks or products. We can only say that it is such a score as the average ten-year-old, the median soldier in the draft, or an average college freshman attains. Binet's original idea was to measure something closely like what I have called level of intellect, but his test was far too short to do so accurately or conveniently. So he, later, and his followers have simply computed a sum of credits score and made a scale of mental ages to correspond.

It would be a very great improvement if we could obtain measures of level of intelligence, range of intelligence, at each level speed, and method each by itself, and then later, combine them with proper weights to form a general estimate or rating of the person, where such is needed.

If we come to take a separate account of level or height of intellect, of range or extent at each level, and of speed at any assigned set of tasks, the problem of units of measure becomes much simplified. It resolves itself into making a valid scale for the intellectual difficulty of the tasks. Once we have valid units and scales for difficulty, all else is easy, for the measurement of range or extent then is simply a matter of number, and the measurement of speed or facility is then simply a matter of time.

We can already put tasks into a rough order for difficulty, for any defined group of intellects. Thus nobody will doubt that it requires (for ten-year-olds born and bred in America) more intellect to know the meanings of a dozen of words like *average, reciprocal, antedate,* and *infinity* than to know the meaning of a dozen like *long, hot, red,* and *two;* or that it requires more to

complete "He must . . . further aid from us, we can not give it" by inserting "forego," than to complete "We wear . . . on our feet," by adding "shoes;" or that it requires more to solve "How many quarters of a quarter equal half of a half of a half;" than to solve "How much is half of four cents?" By suitable research we can make this rough order into an order which is exact to any desired degree. If we can also transmute such a rank order of tasks into a corresponding series of amounts of difficulty such that any difference which we call one will be really equal to any other difference called one, we shall have made an improvement that will insure the continued health, growth, and prosperity of psychological and educational units of measure. If we can further extend the easy end of the series down to a task which is barely above zero difficulty, we shall have won success in all fundamentals and have only to add certain refinements and conveniences.

The analysis into level, range, and speed will probably help to improve the significance of our measurements in many other ways. Some of them we may note briefly here:

First, there is a notable difference of opinion amongst experts concerning the extent to which our present tests, as they are now scored, measure the person's intrinsic ability on the one hand, or his industry and educational advantages on the other. Perhaps education has much greater potency in widening a person's range with easy tasks than it has in raising his level, enabling him to do harder tasks. An imbecile, for example, might be taught to name five hundred objects, but no education could teach him what *reciprocal, average, notwithstanding, therefore,* and *although* meant. Perhaps Professor Whipple would admit that most of what Professor Bagley says about intelligence is true of range or width of intelligence, and Professor Bagley would admit that most of what Professor Whipple says about intelligence is true of the level of intelligence.

Second, is the disagreement about speed. Perhaps the commonest criticisms of our tests and of school achievements which sensible people who understand them make is that speed counts too much in determining the scores obtained. Those who are skeptical of the scores in present tests because of the speed element might be entirely satisfied with it if it were presented as a separate rating, and were used in any combined rating with only a small weight.

A third beneficial result of the replacement of one composite score by separate scores for level, range, speed, and method will be the possi-

bility of distinguishing carelessness from inability and measuring it much more conveniently than we now can. We may define carelessness as doing wrongly something which one is able to do correctly. We may measure it either by giving the person the same task, one that is easy for him, repeatedly (say a hundred times) and counting the percentage of errors, or by giving him a hundred tasks that we know are of the same difficulty and that are easy for him. The first sort of test, repeating the same task many times, is not very educative, and measures carelessness as disturbed by boredom and in a routine performance. Consequently it will be of relatively little value.

If we have a measure of the person's level, we can define "which one is able to do correctly," for example, as "tasks four (or six or eight or ten) degrees easier than those where the person does five out of ten correctly," and secure definite comparable measures of carelessness, undisturbed by boredom or routine.

Finally, the measurement of level or height or intellect seems of special importance, because it is irreplaceable. Nothing else can substitute for it. If certain intellectual work needs to be done twice as fast, we can hire two people instead of one. If we need to have ten thousand of the tasks at a certain low level done instead of one thousand of them, we can train ten or twenty intellects, letting each specialize on a certain thousand of the ten. But if we need an intellect to solve harder problems than we are now having solved, we must simply search till we find it, or find means of creating it. Ten thousand dull men won't do the work any more than one will. If the hundred men of widest range at a moderate level should die tonight, we could replace them tomorrow by piecing together the ranges of several hundred other men. But if the hundred men of highest level died, we could only wait till others were born, or possibly trained.

Because of its irreplacability, the economic importance of level is *sui generis*. If we could buy from Mars three intellects able to find the prevention and cure of cancer, to release and control the energy stored in the atom, and to make nations live with justice and peace, they would be cheap at a billion dollars a year.

These measurements may seem somewhat elaborate and complex in comparison with the single scores and the "ages" to which we are accustomed. They are so because they give more information and expressed in more instructive units. The level measures alone are probably more valuable than the scores and "ages" which we now use, and may be expected to replace them.

In any case, we should not shrink from complexity and elaborateness as such. Cattell has shrewdly suggested that the mind of one baby possesses a complexity and multifariousness com-

parable to the geography of a continent, or the astronomy of the milky way, or the chemistry of all the metals. Mental measurements may have to be elaborate in order to be truthful and reasonably precise. Against pedantic and wasteful complexity we should be constantly on our guard, but equally we must guard against measures, no matter how simple and convenient and plausible, which do not really measure what they claim to measure, or measure it with errors of five or ten percent or even more. Our chief present duty is to improve the truthfulness and precision of our measures of human capacities and school achievements. If the particular ways of doing so which I have suggested are not the best ways, we should find what the best ways are. We need more measures and more convenient measures, but our greatest need is better measures, measures that are truer and more exact.

THE NEED OF A COUNSELING PROGRAM IN SECONDARY SCHOOLS

VIRGIL E. DICKSON
Deputy Superintendent of Schools, Oakland and Berkeley, California

The purpose of this article is to relate some of the outstanding evidence showing the need of a definite counseling or guidance program in junior and senior high schools, and to illustrate some of the data and methods used by the counselors in their work of pupil adjustment.

One of the arguments advanced for the organization of junior high schools is that pupils who have finished six years of the elementary school and who have reached the age of twelve or thirteen years are at a stage of development where the variation in interests, in abilities, and in possibilities for life work are so numerous that a program of education must be flexible if it is to supply the real needs of all boys and girls.

The most common form of junior high school embraces grades VII, VIII, and IX. Beginning with the seventh grade, pupils are supposed to have opportunity, which increases gradually year by year, to elect or select courses suited to their interests, abilities, and future plans. Such selection involves choice, and choice by boys and girls of this age certainly demands guidance. We know that this cross-section of society now at the age of twelve will in twenty years become the portion of society carrying on all types of social and industrial activities in the civilization of that time. Who will presume to give advice to the twelve-year-old, to guide him in his plans for the future? Does anyone know enough to dare undertake such a task? If not we must take one of two courses, either give the same requirements to all, hoping that each may get out of it what is best for him, or we must leave to chance and caprice the selection of the child's path through the labyrinth of electives. We believe that there should be electives and that there must be guidance. This guidance

should be delegated to certain people who are made responsible for obtaining as much scientific evidence as possible on which to base guidance, and who will use methods which will insure that each individual child is made to think of the possibilities within him of meeting the requirements in various avenues of life's work.

Such is the task of the school counselor—a task which demands the very best in personality, in vision, and in training. This task also demands the scientific treatment of all obtainable facts bearing upon proper counseling of all classes of children.

What data are valuable to a counselor? We use in Oakland the following information: (1) chronological age, (2) mental

TABLE I. VARIATION IN CHRONOLOGICAL AND MENTAL AGES FOR ONE THOUSAND THREE HUNDRED SEVENTY-FOUR PUPILS OF HIGH-VIII

	Lowest	Highest	Range of Middle Percent	Median
Chronological age	11-2	18-1	13-5 to 15-0	14-1
Mental age	10-5	16-2	12-7 to 15-5	13-10

age, (3) intelligence quotient, (4) the teachers' rating of school work, intelligence, and industry and application, (5) health rating, (6) the pupil's educational ambition, (7) the pupil's vocational interest, and (8) the parents' desires. In addition, the counselor has the pupil's cumulative record containing: the nationality and occupation of the parents, the date of child's school entry, the record of his attendance in each grade, his general scholarship and conduct in each grade, complete record of promotions, height and weight records taken each year together with numerous other physical data involved in an annual inspection by the health department covering eyes, ears, nose, throat, teeth, heart, lungs, and general physical condition. With such data an intelligent and well-trained counselor should be able to advise far better coordination of the course of study to the pupil's capacity and desires than is possible under either a uniform requirement or chance selection.

Let us illustrate some problems in variation showing the need of guidance. Table I illustrates the variation in 1,374 pupils finishing grade high-VIII ready for entrance into high school. Note that they vary in age from 11 years 2 months to 18 years 1 month; in mental age from 10 years 5 months to 16 years 2 months. While 25 percent of the pupils are *chronologically* more than a year over age for the grade, 25 percent are *mentally* one year and a half over age.

These pupils must plan their work from the following courses offered in the ninth grade:

Required Subjects
English, physical education
Commercial
Bookkeeping, commercial arithmetic, penmanship, typing
Drawing
Freehand, commercial lettering, applied art
Home Economics
Foods, clothing, millinery, household administration
Languages
French, Latin, Spanish
Mathematics
General mathematics, algebra
Music
Band, orchestra, choral, harmony
Science
General science
Social Studies
Early European history, economic and vocational civics
Shop Courses
For Boys: Auto repairing, cabinet making, pattern making, machine shop work, electrical work, and printing.
For Girls: Home making, dressmaking, millinery, printing.

Table II gives in greater detail the distributions of chronological age, mental age, and intelligence quotient of the eighty pupils comprising the group which enter the ninth grade of one of our junior high schools. Three of these are under twelve years of age, while four are over seventeen. Six are mentally under eleven years, while seven are mentally over seventeen years old. The range in intelligence quotients is from 60 to 150. To add to the difficulty the three who are in the youngest group

are the brightest, and the four who are in the oldest group are the dullest members of the class. When we add the data on other variables involving past scholarship, health, home environment, ambitions, etc., and know that the school is faced with the problem of so arranging the program of these pupils that they may utilize the electives of the ninth grade mentioned above, we see that there is need for guidance.

TABLE II. DISTRIBUTION BY AGE, MENTAL AGE, AND INTELLIGENCE QUOTIENT OF EIGHTY PUPILS ENTERING THE NINTH GRADE OF A JUNIOR HIGH SCHOOL

Age Interval	Number of Cases		Intelligence-Quotient Interval	Number of Cases
	Chronological Age	Mental Age		
9-0 to 9-11	0	2	60 to 69	5
10-0 to 10-11	0	4	70 to 79	14
11-0 to 11-11	3	10	80 to 89	9
12-0 to 12-11	7	7	90 to 99	13
13-0 to 13-11	24	18	100 to 109	9
14-0 to 14-11	25	10	110 to 119	19
15-0 to 15-11	15	14	120 to 129	4
16-0 to 16-11	2	8	130 to 139	4
17-0 to 17-11	4	6	140 to 149	1
18-0 to 18-11	0	1	150 to 159	2
Total	80	80	Total	80
Median	14-3	13-10	Median	98

Let us note in Table III the similar data showing variation in the chronological age, the mental age, and the intelligence quotients of 367 pupils who entered Berkeley high school in January, 1924. Here the chronological ages range from thirteen years to twenty years, while the mental ages range from eleven years to eighteen years, and the intelligence quotients extend from 70 to 140.

The median intelligence quotient for the 1,374 pupils entering the ninth grade is 98, while for the 367 entering the tenth grade, it is 103. Every tabulation of a large unselected group reveals the same tendency, namely, that the drop-outs between one grade and the next higher grade always include the larger percentage of

those having low intelligence quotients. This becomes a significant factor in counseling.

With the needs of counseling so clearly evident, the administrative officers in the Oakland and in the Berkeley public schools

TABLE III. DISTRIBUTION BY AGE, MENTAL AGE, AND INTELLIGENCE QUOTIENT OF THREE HUNDRED SIXTY-SEVEN PUPILS ENTERING THE TENTH GRADE

Age Interval	Number of Cases		Intelligence-Quotient Interval	Number of Cases
	Chronological Age	Mental Age		
11–0 to 11–11	0	4	70 to 79	19
12–0 to 12–11	0	31	80 to 89	41
13–0 to 13–11	37	36	90 to 99	83
14–0 to 14–11	139	59	100 to 109	113
15–0 to 15–11	136	93	110 to 119	74
16–0 to 16–11	46	94	120 to 129	26
17–0 to 17–11	5	34	130 to 139	10
18–0 to 18–11	2	16	140 to 149	1
19–0 to 19–11	0	0		
20–0 to 20–11	2	0		
Total	367	367	Total	367
Median	15–0	15–5	Median	103

have made provision for a counseling program. School counselors, selected because of personal fitness for the work, are being trained for greater efficiency while on the job by checking on the proper use of information and the follow up of pupils counseled, and are given specific responsibility for a reasonable efficiency in results according to the time allotted for the work.

Every junior high school and every high school has its counselor or counseling staff. Our results are below what we would like them to be, but we are gradually improving. Six years of experience lead us to desire to continue our plan of counseling on an ever-increasing scientific basis.

A HIGH-SCHOOL COUNSELING SYSTEM IN OPERATION

ELISE H. MARTENS
Assistant Director, Bureau of Research and Guidance, Oakland and Berkeley, California

The Berkeley school system is organized on the basis of the six-three-three plan, and comprises sixteen elementary schools, four junior high schools, and one senior high school. The total school population of 12,000 includes pupils drawn from every type of community, from the section of the city surrounding the university to the typical south European communities on the waterfront and in the factory districts.

The junior high schools are geographically situated to serve the children of the whole city and the curriculum is organized to meet, as nearly as possible, the needs of all types of children in the seventh, eighth, and ninth years of school work. When the time comes for them to leave the lower school, where the enrollment varies from 600 to 1,000 pupils, to enter the senior high school of more than 2,000 students, the problem of how to continue to care for them, to consider their individual needs, to give them the best possible guidance throughout the high-school course, or as long as they remain in the school, presents itself.

This problem has been recognized in many places and has given rise to various types of high-school advisory or counseling plans. For many years the Berkeley high school along with numerous other schools maintained an advisory system, by which each member of the faculty was designated the adviser of some twenty-five or thirty students. The position of adviser involved a two-fold responsibility, a close personal relationship with each student in the group and assistance in all matters pertaining to the selection of high-school courses and plans for future work.

The first of these functions can only be adequately discharged when the teacher regularly meets the small group of pupils who have been thus placed in his care. Although advisers differ greatly in their interest and in their personal ability to reach the

lives of their students nothing better than such an advisory system has yet been devised for this work. The second function, that of giving advice in the selection of school courses and in post-graduate plans, can not so easily be delegated to a faculty of eighty members. Although each one is especially trained and directly interested in his own work, he can not be expected to have an adequate knowledge of all the other departments of the school or of their relationship to the student's mental ability and needs. Educational guidance, if effectively carried on, is a field which, by its very nature, can not be everybody's job. It must be definitely assigned to a small group of people who are given the time and the opportunity to study the school and community facilities and the students' needs. There must be time to survey the whole field of education, time to investigate the possibilities of each line of instruction without prejudice, and time to study the scientific bases upon which pupils' capabilities and individual needs may be judged. High-school counselors must, therefore, be trained—trained through preliminary study and preparation and by actual service, for in this field, as in many others, one can learn best through experience.

Five years ago the Berkeley high school, recognizing the need of adequate counseling facilities to supplement the advisory system already in operation, appointed a school counselor to whom were assigned the general duties relative to educational guidance and high-school research activities. In August, 1923, another step was taken by the appointment of a counseling staff, among whom the various duties were systematically divided. The staff now numbers six *teaching counselors* each assigned to his own field of action, but working in correlation with one another under the general supervision of the *school counselor*. The teaching counselors are so designated because they spend two periods each day in regular classroom instruction, thus allying themselves very definitely with the teaching staff of the school, although they have sufficient time to attend to counseling duties. The school counselor does not teach, but is responsible for the general organization of the work and its correlation with the junior high schools.

Of the six teaching counselors, four are assigned to the work of educational guidance of the students of a given class; that is, all low-X students are under the care of the low-X teaching counselor, while high-X, low-XI, and high-XI students are guided by the teaching counselor of their respective grades. Each counselor follows her[1] own group from term to term so that the counseling relationship becomes an increasingly intimate one as the student progresses in his high-school course. Because of a shortage in school budget the low-XII and high-XII students are as yet without a specific counselor, but are cared for through the joint efforts of their advisers, the school counselor, and the clerks in the principal's office.

The remaining two of the six teaching counselors carry the responsibility of the attendance work, a man being in charge of the boys' attendance and a woman in charge of that of the girls. The checking of attendance is thus an important part of the counseling program. Attendance problems are indeed very real counseling problems and are frequently inseparable from the questions which arise regarding a pupil's scholarship and high-school plans. Consequently there is the closest possible cooperation in the work carried on by the two types of counselors.

The following outline indicates in general the division of functions delegated to this group of people:

School Counselor
- I. Counseling duties
  - 1. General organization and supervision of the counseling program
  - 2. Correlation of work with junior high schools
- II. Research duties
  - 1. Analysis of all secondary-school data relative to scholarship, mental tests, size of classes, etc.
  - 2. Recommendation of policies on basis of such analysis

Four Teaching Counselors (Assigned to educational guidance)
1. Conferences with pupils to discuss high-school plans and to map out programs of high-school work
2. Following up scholarship

[1] At the present time the school counselor and five of the teaching counselors are women; the sixth teaching counselor is a man placed in charge of boys' attendance work.

3. Adjustment of problem cases
4. Establishing close personal contact with pupils and with home
5. Making out pupil schedules of daily work
6. Cooperating with attendance counselors in matters of school discipline

Two Attendance Counselors

1. Supervision of attendance, transfers, drop-outs, etc.
2. School discipline connected with attendance problems
3. Conferences with parents and visits to homes as needed
4. Close relationship with teaching counselors in adjustment of problem cases involving attendance

In order to present clearly the operation of the plan, let us follow the progress of the high ninth-grade pupils in the junior high schools as they prepare to enter the senior high school. The senior high-school counselor works personally with each junior high-school counselor in the arrangement of the program of the pupils preparing to enter low-X. The steps in this procedure are:

1. The junior high-school counselor gives a mental test to all pupils in the high-IX grade and at the same time secures teacher ratings on each pupil independently of test results.

2. Copies of a bulletin of information which presents a brief digest of high-school courses, of requirements for high-school graduation, and of information relative to university entrance are distributed among the pupils of high-IX. The pupil is expected to study this bulletin, to talk it over with parents, and to begin thinking of his high-school program.

3. The high-school counselor meets the pupils in grade high-IX in each junior high school, answers the questions which arise, and gives any supplementary information which may be needed.

4. The junior high-school counselor confers with each student regarding his high-school plans. On the basis of such conferences, together with the cooperation of parents, an introduction card is made out. This introduction card lists the subjects which the pupil plans to take during his first semester in high school.

5. The junior high school sends to the upper school a complete set of data including: (1) the pupils' mental test records, (2) teachers' rating sheets (rating is made of each pupil's capacity, of his schoolwork, and of his industry or application.), (3) records of scholarship, and (4) introduction cards.

With these complete data before her, the high-school counselor prepares for the beginning of the new semester and for the new tenth-grade class. Each student's daily schedule is made out and is ready for him when he enters the high school. In departments where classification into ability groups is the custom, assignment is made on the basis of the data received from the junior high school; in the other departments the merely mechanical process of equalizing the classes is involved.

Once enrolled in the senior high school, these pupils become the particular charge of the low-x teaching counselor, whose responsibility will be to guide them from term to term throughout their high-school course. No final plan of work for any term will be made save in conference with her; no change of program will occur except with her approval. Hence her most immediate concern is to study the programs of these newcomers in relation to the work which they have already done and their apparent ability. When there are approximately 500 students in the group this in itself is no simple matter. As the term progresses, however, numerous other duties demand attention:

1. Checking the scholarship reports of pupils. Pupils of high scholarship are given special commendation, while cases of deficiency are considered for possible readjustment.

2. Reporting to the junior high school the school records made during the first term in senior high school. The individual record sheets are submitted to the junior high school and are discussed by the counselors involved. In this way, much valuable information is brought to bear upon individual cases and general problems of coordination between the junior and senior high schools are considered.

3. Personal conference with each pupil regarding his plans for the remainder of his high-school work. A tentative program is made out for the complete course. Special attention is given to the work to be taken in the succeeding term, and the subjects to be carried during the next semester are definitely outlined.

4. The daily schedule for each pupil on the basis of the subjects chosen for grade high-x is prepared. This is done during the last four

weeks of the semester, after all the conference work is completed and when the school program of classes for the succeeding term has been compiled and is ready for use. In all assignments to classes, student preferences as to choice of teachers and of recitation hours are considered as far as the existing program will allow. This task of making pupil schedules of daily work is largely a mechanical one, and becomes most irksome when carried on for hundreds of students.

5. A spirit of cooperation with the home is developed through telephone communications or personal interviews with the parents when such are desirable.

6. An attitude of confidence and of freedom in discussing personal problems with the counselor is encouraged. This personal relationship between counselor and student naturally increases as the semesters pass and the counselor has the opportunity of deepening her acquaintance with each pupil and his problems.

The activities of the low-x counselor, as already outlined, are duplicated by each teaching counselor.[2] The contact with the home is made more complete by sending a form letter to the parents or guardian of each low-xi student. This letter reports the number of credits earned to date and the program of work for the remainder of his high-school course, with an invitation for personal conference with the counselor on any matters pertaining to the student's school plans. This form letter is reproduced in Figure 1.

Such is the operation of the counseling system of the Berkeley high school. It is important to keep in mind, however, that no counseling program, however highly organized, should free the advisor or classroom teacher from the responsibility of seeking to obtain as intimate a knowledge of the student as is within his power. Any teacher or adviser may discover cases of maladjustment unknown to the counseling staff. In reporting such cases to the proper counselor for consideration and in working cooperatively toward the best possible adjustment, there is opportunity for developing a unity of effort and a solidarity of results which can be achieved in no other way. Even with the closest cooperation, progress will frequently seem slow. Those who are responsible for carrying on the work in Berkeley recognize most

[2]With the exception of reporting back individual case records to the junior high schools, which is done only during the low-x term.

FIGURE 1

BERKELEY HIGH SCHOOL

BERKELEY, CALIFORNIA

.....

My Dear.....,

In order to cooperate more closely with the home in guiding the work of our high-school pupils, the following information is being sent to the parents or the guardian of each of our low-XI students.

.....:

1. Has completed to date.....units of credit as follows:

Subject	No. Units	Grade Rec'd	Subject	No. Units	Grade Rec'd

2. Has planned the remainder of the high-school course in conference with the counselor, as follows:

Low-XI (Subjects being carried this term)	High-XI	Low-XII	High-XII

Sixteen units (including physical education, which is required by State Law) are required for high-school graduation. Recommendation to the university is based upon the seriousness of purpose of the student, the type of work carried in the high school, and the scholarship grades received in the subjects followed. A recommending grade is interpreted as 1 or 2.

The counselor will be glad to confer further with any parent or guardian with reference to the student's high-school progress.

Sincerely yours,

Principal

.....

Low-XI Counselor

clearly its present limitations but are encouraged by its future possibilities. With each succeeding term it is hoped that there will be larger attainments and deeper realizations of what a high-school counseling program can mean in the lives of the students. The ideal toward which every effort is directed is the most sympathetic understanding of each pupil's desires, needs, and capabilities, with the most intelligent adjustment of his school work in accordance with present and future possibilities of accomplishment.

REDUCTION OF OVER-AGENESS

FLOYD T. GOODIER
Chicago Heights, Illinois

Every school system is confronted with the problem of over-ageness. Children do not move forward at the same rate of speed, and, as the course of study is planned for the so-called average child, the slow pupils have difficulty in maintaining their rank. Also average or gifted pupils do not always reach a degree of proficiency in their work which warrants their promotion at the end of a semester or term.

Too often teachers and supervisors take a certain amount of non-promotion for granted and are not much disturbed over failures. They explain the situation by saying either that the pupil is dull or slow and needs to repeat the grade, or that the pupil is lazy or uninterested and must not be promoted both because he is not prepared for the next grade and because he needs the lesson which failure will teach him. There is grave danger in this somewhat complacent attitude. So long as we take any situation for granted, we do not put forth effort to effect a change. The problem of retardation, like other school problems, will never be solved until all the workers of the school system understand the facts, realize the seriousness of the situation, and seek actively to improve conditions.

The writer entered upon his duties as superintendent of the elementary schools of Chicago Heights, Illinois, in August, 1918, and the following October made out age-grade tables for the school system. Table I gives the total enrollment grouped under the three heads, *Under Age, Normal Age,* and *Over Age.*

In formulating the tables, the teachers were asked to refer to their registers and consider each child six years old as long as he was between his sixth and seventh birthdays, seven years old between his seventh and eighth birthdays, etc. Pupils in the first grade were ranked as normal if they were between their sixth and eighth birthdays; in the second grade, if between their seventh and ninth birthdays, etc. Children younger than normal

age were called under age and those older than normal age were placed in the over-age group.

Table II shows the total amount of retardation. That is 539 pupils were retarded a single year; 234, two years; 97, three years; 33, four years; 13, five years; 1, six years; and 3, seven years. Reduced to a unit basis this is a total of 1,522 years.

TABLE I. A SUMMARY OF THE AGE-GRADE SITUATION IN THE SCHOOLS OF CHICAGO HEIGHTS, OCTOBER, 1918

Grade	Number			Percent		
	Under Age	Normal Age	Over Age	Under Age	Normal Age	Over Age
I	12	514	132	.02	.78	.20
II	9	216	158	.02	.57	.41
III	8	235	170	.02	.57	.41
IV	8	176	141	.03	.54	.43
V	5	121	137	.02	.46	.52
VI	7	113	81	.04	.56	.40
VII	10	92	70	.06	.53	.41
VIII	17	96	31	.12	.67	.21
Total	76	1,563	920	.03	.61	.36

TABLE II. TOTAL NUMBER OF PUPILS OVER AGE, OCTOBER, 1918

Grade	Number of Years Over age							
	1	2	3	4	5	6	7	Total
I	90	30	9	1	2			132
II	89	41	15	9	2		2	158
III	97	44	17	6	5		1	170
IV	54	42	31	10	3	1		141
V	77	36	17	6	1			137
VI	47	26	7	1				81
VII	59	10	1					70
VIII	26	5						31
Total	539	234	97	33	13	1	3	920

Table III shows the corresponding situation in the same system of schools in October, 1923, five years later. The methods used in securing the data were the same in both years. The total enrollment during the five years increased from 2,559 to 3,254. One new factor enters into the later table. The school system now includes four special rooms for over-age, retarded

pupils. At the time these data were collected there were seventy-eight pupils in these four rooms and of course these are included in the total number of retarded pupils. The very fact that they are in these rooms classifies them as retarded.

TABLE III. AGE-GRADE SUMMARY, OCTOBER, 1923

Grade	Number			Percent		
	Under Age	Normal Age	Over Age	Under Age	Normal Age	Over Age
I	0	623	99	.00	.86	.14
II	7	329	150	.01	.68	.31
III	5	282	118	.01	.70	.29
IV	7	252	135	.02	.64	.34
V	13	219	118	.04	.62	.34
VI	12	191	109	.04	.61	.35
VII	8	191	62	.03	.73	.24
VIII	31	161	54	.13	.65	.22
Special rooms			78			
Total	83	2,248	923	.925	.691	.284

Table IV corresponds to Table II. Not including the special rooms, it shows 845 over-age pupils in 1923 of whom 551 were

TABLE IV. TOTAL NUMBER OF PUPILS OVER AGE, OCTOBER, 1923

Grade	Number of Years Over age					
	1	2	3	4	5	Total
I	82	14	3			99
II	108	31	9	1	1	150
III	75	27	9	6	1	118
IV	76	30	20	8	1	135
V	56	32	20	8	2	118
VI	65	33	10		1	109
VII	45	14	2	1		62
VIII	44	8	2			54
Total	551	189	75	24	6	845

one year over age; 189, two years; 75, three years; 24, four years; and 6, five years. On a unit basis this gives us a total of 1,280 years.

An examination of Tables I and III shows little change in the number of under-age pupils. In 1918 there were two kinder-

gartens in the school system. A few children from these kindergartens entered the first grade before their sixth birthdays. A shortage of funds made it necessary to discontinue the kindergartens, and now pupils are not enrolled unless they will be six years old by the end of the sixth week of the semester.

The increase in the normal progress and decrease in over-age pupils recorded in the Table III are most gratifying. Every grade except the eighth shows an improvement and here there are 21 percent retarded in 1918 and 22 percent in 1923. The decrease in over-ageness in the other grades is as follows: first grade, 6 percent; second grade, 10 percent; third grade, 12 percent; fourth grade, 9 percent; fifth grade, 18 percent; sixth grade, 5 percent; and seventh grade, 17 percent.

The decrease in the sixth grade is the more significant when we know that between 1918 and 1923 the compulsory school-attendance law raised the requirements for working certificates from graduation from the fifth grade, to graduation from the sixth grade. Naturally this has forced into the sixth grade many over-age pupils who in 1918 dropped out of school at the end of the fifth grade to enter various employments.

The total amount of over-ageness when reduced to a unit basis shows a decrease from 1,522 years to 1,280 years. Table II shows three pupils retarded seven years and one, six years. In 1923, no pupil was retarded more than five years. In this connection, mention should again be made of the special rooms. These are not included in the total of 1,280. As the rooms are ungraded, it is impossible to measure in years the amount of each pupil's retardation. But while these rooms do decrease the totals in Table IV, the difference has little bearing upon the conclusions pointed out in this article. Several means have been used to bring about the improvement which is shown in these tables.

The superintendent has sought to keep the matter of retardation before the teaching corps. Each October age-grade tables have been prepared and discussed with building principals and teachers. Each group has been urged to single out for particular study the pupils who are more than one year over age. Special

effort has been made to discover causes of this retardation and possible remedies. Each year the tables have been compared with those of the previous years and the progress noted. The very fact that the school policy has emphasized the importance of reducing retardation has undoubtedly had its effect.

There has been a gradual but steady improvement in the supervisory force. In 1918, all the building principals taught full-time. In 1923, three principals did no regular teaching, two taught half-time, and only one taught full-time. Also the tenure of principals has tended to increase and as each one has become acquainted with the constituency of her own building, she has been better able to adapt the course of study, the methods, and the textbooks to the pupils under her supervision.

Some credit should be given to the introduction of departmental work in the seventh and eighth grades, and to the summer session of six weeks. The departmental work has enabled each teacher to do more thorough work and to give extra help to slow pupils during the periods of supervised study and from 8:30 to 9:00 in the morning. Also pupils are promoted by subjects and those who fail in one or two subjects at the end of the second semester may complete these subjects during the summer school and advance with the other members of their class in September.

The Immigration Law of 1921, which materially cut down the number of aliens entering the United States, has had a marked effect upon the population of industrial centers like Chicago Heights. In 1918, 1919, and 1920, it was not uncommon to enroll in the schools pupils from ten to fourteen years of age who because of language difficulties were obliged to enter the first grade. Frequently, as they become familiar with the English language, these pupils covered the work of two or three half-years in a single semester, but they were still included among the over-age pupils. Since 1921 the aliens coming to the city from abroad have so decreased in numbers that only occasionally has one entered the schools. While this decrease in aliens has been partially offset by an influx of negroes, the total number of over-age from this source is considerably less than under the earlier conditions.

The attention given to the physical needs of the pupils has increased. Scales have been placed in the school buildings for the monthly weighing and measuring of the children. Report cards include a statement of the weight of the child compared with the commonly accepted standard weight for the given age and height. In some buildings nutrition classes have been held for children 10 percent and more underweight. Mothers have attended these classes and have cooperated by providing proper food for these underweight children, and by seeing that they had sufficient sleep and observed the other common laws of health. At the middle of each forenoon, milk is served in the classrooms and is furnished gratis to the under-nourished children from indigent homes. Eye tests have been given and pupils fitted out with glasses. Through the local Dental Association, all school children have had examinations of their teeth with reports to take to their parents. The school nurse has spent much time in consultation with parents urging that defective eyes and teeth be not neglected. In extreme cases, parents have taken their children to the Institute for Juvenile Research in Chicago, a state institution, where a thorough physical and mental examination has been given and a report made to the school authorities.

One of the chief methods of dealing with the general over-age problem has been through the establishment of so-called "special-rooms" for over-age backward pupils. The first of these rooms was opened in September, 1919, and continued for two years. It demonstrated its value, but, on account of a shortage of school funds, it was discontinued. In September, 1922, the budget again made provision for this work, and since February, 1923, four of these rooms have been a part of the school system. The four rooms take care of about eighty of the most retarded pupils. The location of the rooms makes it possible to take the pupils from eight of the nine buildings of the system and from grades III to VI, inclusive.

There are several ways in which these rooms have helped to reduce retardation. They have removed from the regular rooms pupils who because of age and size were out of place with the

other children. Every experienced teacher knows that two or three pupils of this type are a great handicap to a room. They require much extra help from the teacher, are apt to be embarrassed in the presence of the quicker, stronger pupils, and frequently become disciplinary problems. They also present a serious social problem. Their interests are so different from those of the younger pupils that they feel out of place in many of the activities both of the classroom and the playground.

When placed in a special room with others of similar ability, these pupils lose their embarrassment, find the work suited to their needs, and begin to enjoy the satisfaction that comes from achievement. They find that there are things they can do, and do as well as other members of the class. This sense of mastery, though in very ordinary accomplishments, serves as a powerful stimulus to further endeavor. Is it not possible that this is one of the greatest assets the school can give these mentally handicapped children? If they leave school under the cloud of repeated failures, they are certainly not in a good attitude for any worth-while work in the community, even in those activities which call for only habit-forming processes.

Since the enrollment in a special room is about half that of the regular rooms, the teacher has much more time to devote to the individual pupil. The course of study is much modified. At first emphasis is placed upon reading, easy spelling, penmanship, the fundamental processes of arithmetic, and some place work in geography. Handwork of various kinds—weaving, knitting, wood-working—are given more time than in the regular rooms. As the pupils gain in confidence and interest the program is made heavier. They are led to understand that they are gaining in power and consequently may be expected to do more difficult work.

But the interest of the teacher is not limited to the classroom. Aside from studying the ability of each pupil and giving him the individual attention he needs, she visits the home to become familiar with the background of each pupil. The interest of parents is gradually enlisted. Parents are urged not to regard

the child as hopeless because of past failures at school. They are invited to visit the room and find out just what is being done for the pupils. Frequent reports are sent home, as an encouragement both to the pupils and to their parents.

This is not all. Through the cooperation of such organizations as the Kiwanis, Lions, and Rotary Clubs, additional attention has been given to the physical needs of the pupils of these rooms. All are furnished with milk and in one case, hot lunches are provided for those who live at some distance from the school building. Physicians have examined pupils free of charge, and the clubs mentioned above have provided glasses where the parents were unable or unwilling to furnish them.

Thus by removing these over-age pupils from regular rooms and giving the teacher of these regular rooms a chance to do better work with the remaining pupils, and by actually helping the retarded pupils to cut down their retardation, the special rooms have made a decided contribution toward the solution of this general problem of retardation.

As stated in the beginning of this article every school system must face the problem of the over-age pupils. The problem is more acute in industrial centers with their large foreign population and, in many cases, a large colored population as well. The methods of working with the problem which are described in this article are applicable to almost any school system and will bring results.

DIRECTED DRILL IN THE COMPREHENSION OF VERBAL PROBLEMS IN ARITHMETIC

HARRY A. GREENE
State University of Iowa

Teachers of arithmetic are coming to consider that their two most important teaching tasks are that of increasing the skill with which their pupils use the fundamentals, and that of increasing their knowledge of when to use them. The first deals with the matter of tool acquisition, the question of *how*. The second deals with the matter of use at the right time, the question of *when*. Those who set up arithmetic courses of study tend to standardize somewhat the order of emphasis on these skills. In theory, at least, training in number work up through the fourth grade consists largely of drill having as its purpose the development of skill—accuracy and facility—in these fundamental processes. From this point on there is a tendency to decrease the emphasis on the tools of number work as such, and to give increased attention to the application of these skills in the practical solution of arithmetic problems.

Observation of the methods followed by pupils and measurement of the resulting product both lead to the conclusion that there is a vast difference between the two phases of the teaching of arithmetic. One phase deals with habit formation and the other with the development of technical judgment. The results of measurement show clearly that many children have a knowledge of the fundamental combinations and can give correctly the answers to such examples as

$$\begin{array}{r} 4 \\ 5 \\ 7 \\ 2 \\ \hline \end{array} \quad \text{or} \quad 4+5+7+2$$

but that they cannot solve a simple verbal problem involving the same operation and combinations. Experience in checking the methods followed by a number of pupils leads to the conclusion that *trial* and *error* is too often the practice. Realization of the

serious nature of this condition induced the writer to undertake an analysis of the factors in the solution of verbal problems. His aim was to localize by experiment some of the difficulties involved.

Five fundamental steps in problem solving are noted. These closely parallel the steps in the thinking process as set forth by Dewey. The first step in the solution of a verbal problem involves a thorough understanding of the items, elements, and processes which are stated or implied in it. It is a matter of *comprehension.* This includes many factors, such as the rate of reading, difficulties of vocabulary, the reading of numerals, and the organization of the problem, as well as its complexity in regard to the number and order of the processes involved. Behind all this, of course, lies the ability of the subject to retain the various factors in his memory long enough to analyze and organize them.

This *analysis and organization* is not necessarily recognized by the child but it constitutes the second important step. The unnecessary facts or implications are discarded and only data which really affect the problem are retained for use. In this respect decided differences are found between the poor and the good student. The able student quickly locates the non-essential in a problem and discards it, while the poor student fears to decide and then guesses.

The third step is practically a part of the second, because the act of *recognition* of the process involved is an integral part of analysis. From this the pupil moves straight to the fourth step, *solution,* where he applies to a specific situation his knowledge of the tools of number work. The final step in the process is that of *verification,* which may be a matter of checking merely by estimating the most probable answer or by an actual re-check of the computations and processes.

A little examination of this somewhat theoretical and introspective analysis of the steps in problem solving reveals a number of places where the chain of acquired habits and judgments may break. Truly, in such a complex field as this the chain of learning is no stronger than its weakest link. It is the

classroom teacher's task to forge these links, and—what is equally important—to locate and repair quickly those which have snapped under stress. This is diagnosis and remedial treatment.

In spite of the fact that arithmetic is historically one of the older subjects in the curriculum, the application of certain fundamental principles of learning has only recently been made. Until a short time ago it had never been recognized that all addition combinations are not equally difficult to learn, and the effort has only recently been made to distribute drill material in accordance with these differences in difficulty. It has only recently been recognized that the way to develop arithmetic judgment and skill in reading arithmetic problems is possibly to drill the pupils thoroughly in these operations.

The basis of such drill depends upon the validity of the steps outlined above. The final step, verification, is merely the process of finding out whether the solution is satisfactory. The solution depends upon the child's knowledge of fundamentals; and we know that this knowledge can be improved by drill. The remaining operations—comprehension, analysis, and recognition of processes—are not quite so simple, nor are they so directly improvable by drill. It is known, however, that properly arranged drill will noticeably increase the speed with which children read arithmetic problems[1] and the extent to which they understand them. Miss Wilson's study showed that significant gains were made when thirty-four sixth-grade children were drilled on reading such problems as those in Stone's Reasoning Test. Similar conclusions were reached by one of the writer's students working with an advanced eighth-grade class of twenty-three pupils. Form I of Stone's Reasoning Test was given and followed by five days of drill on similar problems during the arithmetic period. The same form of the test was then given. A class gain from 6.2 points in the preliminary test to 12.4 points in the final test was apparently secured by this brief drill period. Obviously part of this improvement was due to the repetition of

[1] Wilson, Estaline. "Improving the Ability to Read Arithmetic Problems," *Elementary School Journal*, 22:380-86, January, 1922.

the same form of the test, but later experiment showed that this was not a very significant factor.

In an unpublished study another of the writer's students, after experimenting for five weeks with a group of twenty sixth-grade pupils, concluded that the increase in skill in the fundamentals resulting from drill on the Courtis Practice Pads did not appreciably affect the reasoning scores of these pupils on Stone's Reasoning Test and Monroe's Reasoning Test. Here an inadequate number of cases limits conclusions, but a strong suspicion is raised that other more complex abilities underlie success in solving reasoning problems.

The foregoing discussion seems to show that pupils respond to drill on the reading of verbal problems by increasing their reasoning scores; and that they fail to respond in a like degree when drilled on fundamentals. These are only tentative conclusions based on too few cases, but they offer a point of departure for the investigation of the remaining steps. These steps have all been subjected to analysis, and have all been tentatively evaluated with the exception of training in selecting and recognizing the process involved in the solution of the problem. A brief report of an attempt experimentally to determine the value of drill on this phase of the problem constitutes the balance of this paper.

A large number of verbal problems of a simple and practical sort were selected from a variety of sources. Many of these were afterwards eliminated because of vocabulary difficulties, and many more because of ambiguity or lack of social utility. Out of several hundred problems, eight forms of practice exercises, each containing 16 problems, were developed. The first four forms consisted of problems involving a single process. Forms V, VI, and VII consisted of problems involving two processes; and Form VIII was made up of problems involving three processes. Form II is presented herewith as an illustration.

Verbal Problem Practice Tests

Illustration:
We have 10 boys in our room. Four are absent today. How many boys are present? **S** .....

Key
A—Addition
S—Subtraction
D—Division
M—Multiplication

1. My reading book has 120 pages. I have read 72 pages. How many pages have I to read? .....
2. My father gets $7.00 a day for driving an auto truck. How much does he get in four days? .....
3. If I spend 5c for candy, and 10c for cookies, how much do I spend in all? .....
4. One postage stamp costs 2c. How much will five stamps cost me? .....
5. A farmer had 42 sheep and sold 23. How many had he left? .....
6. I can ride a mile on my bicycle in 10 minutes. How far can I go in 30 minutes? .....
7. At my party each child had three sandwiches. If 9 children were present, how many sandwiches did we have to make? .....
8. A boy bought a loaf of bread for 10c and gave the grocer 25c. How much change did he receive? .....
9. At 5c each how many oranges can be bought for 50c? .....
10. I am ten years old. My brother is nine years older. How old is my brother? .....
11. Father's pay is $20.00 a week. How much does he earn in five weeks? .....
12. I earn $2.00 in a week. My brother earns $4.00 in a week. How much do we both earn? .....
13. If three apples cost 15c how much did one apple cost? .....
14. There are 12 girls and 16 boys in our schoolroom. How many children are there in the room? .....
15. My mother had $10.00 and bought some shoes for $7.00. How much money did she have left? .....
16. Frank shines shoes. He charges 10c a shine. One day he earned 60c. How many shines did he give? .....

FORM II Name.....Grade.....
Practice Tests City.....Date.....

The experiment was conducted in the four sections of the sixth grade in an excellent school system. The teachers were interested in the problem and thoroughly aware of its significance. There were sixty-two pupils in the experimental group and thirty in the control group. A preliminary test using Form I

of Monroe's Standardized Reasoning Tests in Arithmetic was given to the sixty-two pupils in Schools A, B, and C. The group of thirty pupils in school D was also tested at the same time and used as a control group. The three groups of pupils in schools A, B, and C were drilled ten minutes a day for eight days, using the eight specially prepared drill forms. Each child's paper was checked daily and he was warned of any general error in following the practice procedure, but was given no chance to go back over his paper and correct the errors. The complete experiment, including drill periods, was planned to be administered in 100 minutes and to be spread over not more than two weeks. On the tenth day of the experiment the same form of

TABLE I. MONROE REASONING TEST FORM 1, TEST 1

	Number of Pupils	First Testing		Second Testing		Gain
		Mean	P.E.M	Mean	P.E.M	
Correct Principle						
Drill groups	62	11.33	0.72	15.82	0.86	4.49
Control group	30	22.20	1.08	24.94	1.06	2.74
Correct Solution						
Drill groups	62	6.00	0.49	8.74	0.51	2.74
Control group	30	12.12	1.85	12.74	1.98	0.62

the Monroe Reasoning Test was again given to all four groups of children. The results are summarized in Table I.

An examination of this table shows that in selecting the correct principles per problem solution the drill group gained 4.49 points while the control group gained 2.74 points. In accuracy of solution the drill group advanced on the average from 6.00 to 8.74 points, a gain of 2.74 points; while the control group advanced from 12.12 to 12.74 points, a gain of 0.62 points due to maturity and the repetition of the same form of the test.

It is clear that these apparent differences between the two groups are not directly comparable because the gains in accomplishment are computed at different levels on the scales of values for the test.

An advance from 22.0 to 23.0 points undoubtedly represents an achievement different from that of an advance from 6.0 points

to 7.0 points. This difference is partly taken into account by expressing the gains as percentages of the total gains possible for each group. Table II shows this comparison.

As to correct principle, this table shows gains in percentage points of 10.2 and 6.5 for the drill and control groups, respectively. These percents are not directly comparable because of the different levels of achievement represented; undoubtedly the 6.5 percent gain is not as large as it should be because of the fact that such a high initial score was made by the group. The question, then, is: What gain, in percentage points, on the part of the drill group is equal in point of achievement to the gain of 6.5 made by the control group? This equating is performed by

TABLE II. THE PERCENT WHICH EACH MEAN SCORE IS OF THE TOTAL POSSIBLE SCORE

	First Testing	Second Testing	Gain
Correct Principle			
Drill groups	25.8	36.0	10.2
Control group	50.3	56.8	6.5
Correct Solution			
Drill groups	20.7	30.2	9.5
Control group	41.7	43.9	2.2

NOTE: Possible score in correct principle, 44; possible score in correct solution, 29.

solving a proportion in which the first term is the obtained gain of the control group (6.5), the second is the unknown equated gain and in which the third and fourth terms are the difference between the total possible percentage score (100) and the actual percents for the control and drill groups:

For example: $6.5 : x :: 100\text{-}50.3 : 100\text{-}25.8$
$6.5 : x :: 49.7 : 74.2$

Whence, x is 9.7 percent, which the drill groups must equal in order to be on equal terms with the control group. The drill group, however, made a gain of 10.2 percent, which leaves a net equated superiority of 0.5 percent on the matter of correct principle. Similarly, in respect to correct solution, a computed gain of 3.0 percent is necessary before the drill can show any superi-

ority. Since the actual gain was 9.5 percent, a clear advantage of 6.5 percent is shown for the drill group.

A number of factors tend to limit the results of this brief experiment. In the first place, the number of cases was too small for any great reliability. In the second place, the number of measures taken in the preliminary and final tests was probably insufficient. In the third place, the test used was not standardized for the sixth grade. Test I of this series is for grades three, four, and five, and therefore lacked "top" enough adequately to test the ability of sixth-grade pupils. Theoretically this would tend to cover up a good part of the really effective gain. A fourth limitation lies in the fact that at the end it was necessary to use the same form of the test as was used at the beginning. It is doubtful whether on the basis of two uses of the same form of a test it is an adequate correction to use the control group as a means of determining approximately the amount of gain made by a sixth-grade class merely as the result of *living* ten days. There is a fifth limitation in that a very limited amount of drill time was used, and this without the ordinary benefits accruing from the self-correction of error. There is no way of determining in this experiment how much more valuable doubling the drill time might have been, nor how much additional gain might have been made by going through the complete cycle of practice forms a second time.

In general, this investigation tends to show that it is better to spend even a very limited amount of class time in drilling on the selection of the processes necessary to solve a verbal arithmetic problem than to follow the normal classroom procedure, as in the case of the control class. This drill, strangely enough, seems to increase the accuracy of problem solution more than the ability to select the correct principle to use in solving the problem —that is, as far as the latter factor is measured by the test used in the experiment. After all, it begins to look as if at least some of the steps in problem solving might be largely reduced to a drill procedure from which greatly increased efficiency of instruction may result.

HOW TWO HUNDRED AND FIFTY-EIGHT JUNIOR COLLEGE WOMEN STUDY[1]

JESSIE ALLEN CHARTERS
Pittsburgh, Pa.

It has seemed profitable—novel, too, perhaps—to determine, as a basis for some of our rules about the best way to study, just how people are studying. A report has already been given upon the results obtained by interviewing some seventy college women concerning their methods of study. These young women were selected groups, and the purpose of the interview was to learn the facts about methods pursued in the study activity.[1] After the principal difficulties attending the study process were brought to light in these interviews and the major activities listed, we decided to submit a questionnaire to the students in Stephens Junior College.

A carefully devised questionnaire was, therefore, given to two hundred fifty-eight junior college women. All first-year students and more than half the second-year students were enrolled in English classes.[2] The questions were handed to these classes in English, but the students were assured that the papers were in no sense a test in English and would not be read by their instructors. They had been prepared for this questionnaire by having heard an assembly talk on the subject of problems of study, and many of them had met and talked with the investigator. A few of them had previously reported in a formal interview.

The questionnaire covered four main topics: studying a textbook assignment, memorizing, distraction and concentration, and note-taking.

Studying a Textbook Assignment.—This phase of the problem was introduced by the question, "How do you fix the main

[1] Charters, Jessie Allen. "Methods of Study Used by College Women," *Journal of Educational Research*, 10:344-55, December, 1924.

[2] For the formulation and supervision of this questionnaire I am greatly indebted to Roy Ivan Johnson, professor of English composition in Stephens College.

points in reading a text assignment such as five pages in history or sociology?" The replies may be summarized as follows:

		Students
1.	Read the lesson	
	Once	106
	Twice	114
	Three times	23
	More than three times	0
2.	Make an outline	99
	Make an outline (sometimes)	3
3.	Underline words	8
4.	Take notes in notebook	12
5.	Make marginal notes in text	91
6.	Recite it aloud	9
	Recite it aloud (sometimes)	3
7.	Recite it in a whisper	11
8.	Recite it in the mind only	69
9.	Make written summary from memory and check up	20

The replies to the question, "Do you systematically review your text?" are summarized in Table I.

TABLE I. DO YOU SYSTEMATICALLY REVIEW YOUR TEXT?

	Yes	No	Sometimes
Before test	128	16	7
Daily	36	144	11
When you need certain facts previously learned	204	21	2
When writing a paper	203	11	4
To answer questions in an assignment	177	25	9

Seventy-one students reported that when studying they attempted to connect the important points with something in their own experience, thirty-three did so sometimes, while one hundred and twenty-four made no such effort. Although only a small proportion of the students gave instances of connecting their lessons with their own experience, the same individuals often gave several examples, suggesting that it was habitual with them. The subjects thus connected with experience were:

	Times		Times
Psychology	18	Sociology and economics	5
English	4	Household science (Foods)	5
Music	3	History	3
Language	2	School management	2
Hygiene	1	Subject not mentioned	2

Some of the examples of practical illustrations suggested by the students were interesting. One student applied the wage

problem to her own community, another connected present events with past history, and still another tried to relate "the rules and the forms of verbs in Spanish with rules and forms of French." Another, having learned that there are several classes of people, mentally, said that the "people all around me seem to me to fit into these classes." Psychology provided several interesting examples:

The study of memory brings up my own experiences in memory work.

I compare the theories of the working of a child's mind with my own experience.

I always try to notice original instincts in people by watching them, and noticing what they do.

To the question, "How far back do you go for the purpose of reviewing?" two hundred and two students replied, "far enough to cover all points;" while one student said "two hundred pages or less."

The replies to the question, "What kind of review do you make for final examination?" may be summarized as follows:

	Students
Text	134
Notes and outlines	125
Outlines	27
General summary	13
Fresh notes	11
"Cram"	4
Concise review	1
Spasmodic review	1
None	1

The students made some interesting remarks about their methods of reviewing the textbook. Most of them seem to review only when required to do so because of a threatening examination.

I begin reviewing where the last examination stopped.

I review only things I've forgotten.

I see if I can answer probable questions.

I pick out main points and whisper them.

I divide the book into several parts and take each alone.

If there is something I am sure I do not understand I review that. Otherwise I do not review for it "muddles" the facts in my mind.

I try to go over the whole book, and most of the time I never get through the book.

I don't believe in "cramming" and do not review except to grasp the main points of the subject.

I try to make my review comprehensive, laying emphasis on the most important facts, and finally write a summary from memory and check up.

Methods of Memorizing.—The various methods of memorizing which the students mentioned in reply to the question, "How do you memorize a poem, for instance, 'The Village Blacksmith?' " are summarized in Table II. To the question, "How many times do you read it all?" 50 students replied once; 34, twice; 35, three times; 10, four times; 11, five to eight times; and 2, eight to twelve times.

TABLE II. METHODS OF MEMORIZING

	Yes	No	Sometimes
Do you read it as a whole?	213	16	.....
Do you study it stanza by stanza?	170	45	14
Do you have someone read it to you?	1	93	4
Do you write it out when learning it?	88	82	55
Do you read and recite it aloud as you are learning?	174	24	19

Various standards of determining when a selection was learned were found: "When I can repeat it without a mistake" was the standard set by one hundred and forty-three students; "When I can repeat it and know the meaning," thirty-one; "When I can recite it to someone," twenty-five; "When I can say it a few hours after I have memorized it," sixteen; "When I can say the whole twice," nine; and "When I can repeat it perfectly with expression," three. The replies to the question, How do you remember dates in history? range from "By connecting them with other important dates" to "I don't remember them, because I have no special method." The replies to this question have been summarized as follows:

	Students
By connecting with other important dates	125
Just by learning them	44
Frequent repetition	17
By centuries	9
Only remember very important dates	8
I visualize them	8

By finding something unusual about the numbers	4
I write them down	2
Association with customs and events	2
Sometimes have verses	2
By connecting with books I have read of the times	1
By incidents in my life	1
By the way they sound	1
I write them in the air	1
I don't remember them because I have no special method	1

The request that they tell anything of interest concerning their methods of remembering and memorizing gave an unexpected emphasis to the practice of writing: "I have to write everything several times to memorize it. Especially is this true of Spanish words or in spelling." This method seems to be much more frequently used in memorizing vocabularies, tables, words, etc., than was indicated in the answers to the question about memorizing a poem. Many say that they write out a poem or piece of music, and then they can visualize it as they have written it. Others write out the selection, because they find that they can visualize the selection as it appears in the book much better than if they had not written it.

Many young women mentioned their efforts to remember things by connecting them with familiar events, while others said that interest influenced remembering. Most of the students mentioned the greater ease of remembering and of memorizing material which they *thoroughly understood*. Some interesting individual comments on this phase of the problem were:

I find it easier to memorize when I am in a quiet sort of mood, perhaps a little homesick.

The best time for memorizing is just before light bell, when I can get the poem firmly fixed in mind and then repeat it or think about it just after I go to bed. (Mentioned by several.)

I say it when I am dressing, or cleaning up, or going for a walk.

Distraction and Concentration.—To the question, "Can you study in a room where people are talking and moving about?" fifty-seven pupils replied "yes;" forty-three, "sometimes," and one hundred and fifty-eight, "no." Some of the interesting comments made when giving these answers were: "It depends on the subject I am studying." "If necessary it is possible." "Yes, but it takes twice as much time." "It comes with practice."

When asked to describe any device which they used when they *must* study under such distracting conditions, the following replies were received.

	Students
I concentrate by becoming interested	115
I just do not pay attention to disturbances	42
I try to forget disturbances	32
I read aloud or whisper	22
Go to a quiet room	21
I stop my ears	20
Go to another part of room	11
I turn my back on the others	8
Study lesson which takes less concentration	7
Write down what I am studying	4
I go over and over what I am studying	3
Read slowly	1
I use a *great deal* of repetition	1
Read or study aloud, and listen to myself, and so drown out the others	1
I do not face the group, as movement attracts my attention while sound does not	1

The unanimous decision of the two hundred and fifty-eight students concerned in this investigation was that it is easier to concentrate on some subjects than on others. One hundred and eighty-eight students gave as the reason that some subjects were more interesting, while forty said that some subjects were easier, and forty-two that some subjects were better liked.

TABLE III. SUMMARY OF THE REPLIES TO THE QUESTION, "WHAT TIME OF DAY DO YOU DO YOUR BEST WORK?"

Reasons	Morning	Afternoon	Night
Not tired	79		
Clear mind	78	7	5
Fewer distractions	25	9	20
Habit	1	1	4
Feel freer	2		
Feel better		9	
More time		6	
Mood		2	
Afternoon exercise refreshing			1
No reason given	10	2	1
Total	194	36	41

The summary of the replies to the inquiry, "What time of day do you do your best work?" is given in Table III. Two stu-

dents had no preferred time of study, while another student who studied between 8 in the morning and 4 in the afternoon gave as her reason, "My mind seems to be on school work during school hours."

Note-taking.—The questions under this topic were given in part to determine the relative amount of notebook work required of this group of girls. Since we have no data from other colleges, we do not know whether Stephens College girls do more or less notebook work than is the custom in similar colleges. One question was: Estimate very carefully the number of hours per week you spend on copying and reviewing notes. Do not include the time occupied in class or in reading references upon which you take notes. The replies ranged from 0 to 15 hours:

Hours	Students
0	4
¼	2
½	10
¾	1
1	23
2	44
2½	6
3	28
3½	2
4	22
5	11
6	14
7	7
8	1
10	3
14	2
15	2

The evidence here indicates that students have a tendency to estimate their work in round numbers, as two hours, three hours, or four hours.

From the replies to the question, "Do you like to keep notes?" it was found that one hundred and eighty-six students like to keep notes, fifty-seven do not; thirteen like to in some subjects, while five "do not mind it." The question, "Of what use are notes?" elicited the following replies:

	Students
For review	157
Future reference	39
Aid in remembering	77
Keep work systematized	9

Condense work	26
No use	3
For teaching	3

It was the opinion of two hundred and twenty-one students that they would have done poorer work if they had not kept notes; fifteen thought their work would have been improved; three thought note-taking had no effect, while seven did not know. One hundred and seventy-five of these pupils had no definite instruction in note-taking in high school, five had received very little, while eighty-one had received some instruction.

Conclusions

1. In studying a text assignment the most frequently used steps in preparation are: (1) by reading once or twice, (2) by outlining, (3) by making marginal notes, and (4) by mental review or recitation. Some application of the information or principles to everyday life is made by about one-fourth of the students.

Reviews are by no means universal, though more than half the students review if they have some compelling motive, such as an examination or review assignment.

2. Not more than a dozen of the two hundred fifty-eight students use the whole method entirely for memorizing verbatim, although many of them have had its advantages pointed out by the psychology teachers.

3. "Learn to concentrate" has been a rule which these students were taught from their first-grade days. But it is a form of mental activity which proves difficult under boarding-school conditions, and, therefore, the girls are conscious of many interesting aids to active attention. The will to be interested, bodily postures, supplementary actions (writing, whispering the lesson), and prolonged repetition are the main devices depended upon to aid concentration.

4. Notebooks are believed to aid in the learning process, but there is a great diversity in the kind of notes taken, while instruction in the best way of doing this work is often lacking.

AN EFFORT TO MEASURE TYPING EFFICIENCY

WILLIAM A. COOK
University of South Dakota

Criticisms of existing systems.—Some years ago the writer, then a school inspector, became interested in the subject of typewriting for two reasons: first, because many colleges were refusing to accept it for entrance on account of its uncertain character; and second, because as interest in educational measurements increased much attention was being given to calculating proficiency in subjects where the objectives were much more complex than in typewriting.

It is true that even then "monthly tests" were being distributed to the different schools by manufacturers of several of the standard machines. The resulting contests were unsatisfactory because the tests were directed toward the discovery and development of "stars" whose names might be used by manufacturers for advertising purposes. By a grading of awards the interest of the average pupils was occasionally aroused, but for the most part the teacher's attention was focussed on the upper ten percent. No standards were developed for the class as a whole, and hence the central problem of supervision and inspection, the progress of the mass, remained almost untouched. On the other hand, the standards of achievement were by no means absolute, since the word was taken as the unit of measurement. Three different typewriter companies sent out in the same year tests varying from 110 to 140 syllables per hundred words, and from 485 to 535 strokes per hundred words. Obviously the word as a unit is not at all constant in different passages. The system of penalizing errors was also unfair and unreasonable. The practice of subtracting five words from the gross rate for each error, in order to secure the net rate for the ten-minute test, made all errors equally important. Yet it is quite clear that from the standpoint of the reader some errors are far more serious than others, and that some are far more difficult to correct than others.

Effort to overcome the criticism.—An effort was made by the writer to devise a method of testing and rating that would be free from these faults. About thirty-five high schools permitted him on inspection trips to test their classes in typewriting. Approximately 550 students participated in these tests; all of the class were included as far as time permitted. Some fifteen schools also administered monthly tests in accordance with a uniform plan. From these data a rating was derived for the class or classes of each school, the achievement of the median pupil being the basis of class rating. The entire body of data was used to graph a general curve of progress of typing classes, drawn so that an equal number of classes lay above and below it.

The test passages were selected so as to employ few words which were not in the reading vocabulary of all high-school pupils, and while the shift key was used for various purposes, an unusual amount of shifting was not required. The stroke instead of the word was taken as the unit of measurement for speed. All the strokes, both of the space bar and of the letters, were counted. No effort was made to compare the difficulty of a stroke of the space bar and a stroke of a letter, nor was consideration given to differences in difficulty of various letter sequences. Every teacher of typing knows that some letters are less used and are therefore more likely to result in an error, and also that certain letters are very easy and natural in some combinations but very difficult in others. *S* is much more used than *x* and, in general, is easier to execute, but *escape* and *especially* are very apt to be *excape* and *expecially*. In other words, they present letter sequences in which *x* is easier and more natural than *s*. The difficulty of unusual letter sequences is shown again by the hesitancy of a typist in copying a passage in a foreign language, no matter how plain. The writer has not been able to devise a method that will take into account the comparative difficulty of letter sequences, but has based his calculation of speed entirely upon the number of strokes per minute.

The penalization of errors was arranged according to a scheme adapted from certain state and federal civil service regu-

lations and predicated on the principle that some types of error are far more serious than others. The penalties were as follows:

A. Four shall be deducted for writing one line over another, in whole or in part.

B. Two shall be deducted for:
(1) Each omitted or incorrect letter or figure
(2) Each omitted or repeated word, except where two or more consecutive words are omitted or repeated; then four shall be deducted for each line or part of line of copy so omitted or repeated.
(3) Each word added
(4) Each word substituted
(5) Each transposition of words
(6) Each error in compounding words, or vice versa
(7) Each abbreviation not found in copy

C. One shall be deducted for:
(1) Each failure to capitalize or punctuate as in copy
(2) Each failure to paragraph uniformly, except that not more than four shall be deducted for this error.
(3) Each failure to space between words
(4) Each case of inconsistent spacing between lines
(5) Each case of spacing between the letters of a word
(6) Each stroke of a letter instead of the space bar
(7) Each case of extra space between words, except that not more than five shall be deducted for this error.
(8) Each failure to space after punctuation marks
(9) Each case of crowding letters in a word
(10) Each case of spacing between a word and the mark of punctuation following it
(11) Each case of extra spacing after punctuation marks
(12) Each additional letter struck in a word
(13) Each letter struck instead of a punctuation mark, or vice versa
(14) Each mark of punctuation placed on next line from word it follows.
(15) Each word unfinished because of coming at end of line, word being rewritten on next line.
(16) Each case of running off paper on right-hand margin
(17) Each irregularity in left-hand margin, or gross irregularity in right-hand margin, except that not more than four shall be deducted for this error.
(18) Each strike-over
(19) Each omitted letter or figure, when space is left for it, showing that key has been struck.

(20) Each transposition of letters in a word, or figures in a number
(21) Each incorrect division of a word at the end of a line
(22) Each omission of the hyphen when needed at the end of the line.
(23) Each interlineation of a word, except that not more than two shall be deducted for a single interlineation.
(24) Each erasure, except that not more than five shall be deducted for this error.

D. From one to five may be deducted for lack of neatness, or for any error not specified above.

E. On no word shall the total penalty be greater than that for the most serious error occurring in that word.

The principal purpose of the maximum allowance mentioned in several cases is to protect the student against a defective machine.

Method of grading.—Pupils were always told that the aim must be as much speed as practicable with a high degree of accuracy, and that work done rapidly but poorly would hardly result in as high a grade as would less work done in a marketable fashion. The papers were graded by calculating the total number of strokes executed. This was made simple by comparing the pupil's paper and a copy of the test marked off at short intervals to indicate the number of strokes. The next step was to divide the total number by ten, the number of minutes covered by the test, in order to find the number of strokes per minute.

The papers were then checked as to their accuracy and the penalties given above were applied. The grade for accuracy was computed by increasing or decreasing the total amount thus deducted so that it represented the probable total of penalties if exactly 1,600 strokes had been written. This probable total for 1,600 strokes was then subtracted from 100 to give the accuracy grade. The accuracy and speed grades were finally combined by adding the accuracy grade and one-third of the number of strokes per minute, and dividing the sum by 2. The quotient was taken as the student's final grade.

To illustrate the grading of a paper, assume that a student makes in ten minutes a total of 1,942 strokes (including those of the space bar), and that 17 penalties are assessed.

Speed per minute = 1,942 ÷ 10, or 194.2

Probable penalty on 1,600 strokes = $\frac{1,600}{1,942} \times 17 = 14$

Accuracy = 100 — 14, or 86

Speed per minute, 194.2, divided by 3 = 64.7

Accuracy grade = 86.

$2\overline{)150.7}$

Final grade = 75.35

Regulations for conducting tests.—The teachers were in all cases directed to give any warming-up exercises that seemed advisable. To facilitate correction and handling the tests were written in double space on 8½″ x 11″ paper. Machines were set for a maximum length of line of seven or seven and a half inches. The exact indentation for paragraphs was not specified, but it was expected to be uniform for each paper. All copy for tests was mimeographed in double spacing lengthwise on 8½″ x 11″ paper, so that divisions between lines on the pupils' papers could not be the same as on the copy.

TABLE I. NORMS OF ATTAINMENT FOR VARIOUS AMOUNTS OF PRACTICE

40–45 Minute Periods of Practice	Strokes per Minute	Final Grade	Amount of Credit (Units)
90.....	45	52.5	0.25
100.....	54	54.	
180.....	105	62.5	0.5
200.....	114	64.	
300.....	156	71.	
360.....	174	74.	1.0
400.....	186	76.	
500.....	210	80.	
540.....	216	81.	1.5
600.....	225	82.5	
700.....	234	84.	
720.....	236	84.35	2.0
800.....	240	85.	
900.....	244.5	85.75	2.5

A general norm of achievement.—In Table I the norms of attainment for various amounts of typing practice are given under *Final Grade*. *Strokes per Minute* are not actual norms, but they are suggested as norms which would give the *Final Grade*

placed after each. Throughout Table I an accuracy grade of 90 is assumed. A paper the accuracy of which is less than 90 is hardly marketable, and it can almost be rewritten by a competent typist in the same time that it would take to correct the errors neatly. An accuracy grade of 90 is, therefore, a commercial norm, an ideal toward which the teacher should direct his class. On the other hand, accuracy much above 90 is hardly practicable, for to reach it the pupil would be compelled to decrease his speed to a damaging extent.

Of course the schools which contributed material for the establishment of these norms were working under widely different conditions. Some had practice wholly supervised, others provided partial supervision, and some supervised none of the pupil's practice, the corrected work returned to him being the only contribution made by an overworked teacher. Some schools made typing a half-time subject with only one period per day, while others operated on the system, now recognized as much less efficient, of requiring two daily periods of practice and giving a full unit of credit for the year. Some schools had periods of fifty or fifty-five minutes while others had barely forty. It should also be stated that certain additional tests, which can not be described here, indicate that a class should do approximately 5 percent better when tested by its own teacher or principal than when tested by a stranger. For the first half unit, the norms indicated by *Final Grade* in Table I should be raised about 10 percent for rating in schools with longer periods and full supervision of practice; for the second and half unit, they should be raised about 5 percent; and for the still more advanced students, a less amount.

Absolute and percent grades.—The *Final Grade* is of course on an absolute scale, not a percent scale. The absolute grade of a student or a class must, therefore, be transformed into a percent grade by a simple proportion. For example, if the absolute grade of 62.5 is normal for a class completing a half unit of the subject, that absolute grade is to be equated to a normal percent grade for the whole class, probably about 82 percent, on

the basis of a passing grade of 70 percent. An absolute grade of 71 would be changed to a percent grade by the proportion $62.5:71::82:x$.

Measuring the individual.—Let us now examine briefly some of the problems arising in the use of such a measuring scale for determining individual ability. To compare schools, a single test may be given by the inspector or supervisor and the normal performance of the class may be judged by its showing on that test, assuming that a typical day and hour are selected. No class is likely to do itself justice immediately after leaving a "pep" meeting, or just before some eventful interscholastic event.

But with a pupil it is a very different matter, since individual factors which he can not begin to explain enable him to work at his very best in the forenoon and perhaps render him incapable of anything like a representative exhibition in the afternoon. Even within the space of ten minutes a marked change may occur, so that errors are bunched thick in one part of a test paper and almost wholly absent in another part. The writer has been experimenting with classes in the University High School at Vermilion for the past four years in order to arrive at a fair estimate of individual ability. Sixty-five pupils have been tested ten minutes daily for three consecutive days at the end of the first semester, and at the end of the second semester a similar procedure has been followed with 47 pupils. Nearly all of the tests have been given on Tuesday, Wednesday, and Thursday, on the assumption that interfering and distracting influences would then be at a minimum.

A single test not adequate.—The extent to which performance varies from day to day shows quite plainly that a single test might do great injustice if it were taken as the sole indication of a pupil's ability. Twenty-eight of the 65 students tested at the end of the first semester displayed a variation of more than 10 percent between their best and worst performances. That this is partly due to the excitement caused by an examination is shown by the fact that of the 47 tested the second semester only eight displayed a difference of more than 10 percent be-

tween their best and worst papers. Nevertheless, a large number of pupils tended to vary considerably on one test of the three. For example, the worst grade made by 37 of the 102 pupils was at least three times as far below their median for the three tests as their best grade was above the median. Twenty-seven others on their best paper of the three surpassed their median grade of the series by three or more times as much as the difference between poorest grade and the median. And yet, despite this tendency to vary, the grades for over three-fourths of the pupils on two of the three tests were less than 5 percent apart, and about 40 percent had two grades differing by less than 1 percent. Consequently it is safe to assert that a student does not require more

TABLE II. PRACTICE EFFECT

Semester	From Test:	Number of Students			Median Gain (Percent)
		Gaining	Losing	Equal	
First	1 to 2	41	23	1	2.01
	2 to 3	35	30	0	1.11
	1 to 3	45	20	0	2.67
Second	1 to 2	27	20	0	0.78
	2 to 3	23	23	1	0.00
	1 to 3	24	23	0	0.02

than three tests except in rare cases, which can easily be discovered by an observant teacher, and that in many cases two tests will be sufficient because they will result in practically identical grades.

Practice effect of tests.—It might be thought that the practice effect of one test on those following it would be considerable, and so render it unfair to stop some students short of three tests, while others completed the series. In Table II data are given for the practice effect of these tests. Difference in difficulty of copy for the tests does not explain the improvement because the classes were divided into three nearly equal sections. One division wrote the passages in the order A–B–C, another wrote them in the order B–C–A, and the third wrote them in the order C–A–B. With their own teachers giving the tests, the improvement from

day to day is not marked. Apparently, however, that from the first to the second test is considerably greater than that from the second to the third test in the first semester. Evidently it does not take the pupils long to recover from most of their nervousness, especially if they have been accustomed to frequent tests. Very few new students enter in the second semester, and the class is accordingly so advanced and so self-possessed that the second and third tests present a negligible improvement over the first. For the first semester, the improvement on each successive test due to practice is about 1.35 percent (half of 2.67 percent).

TABLE III. DIFFERENCE IN DIFFICULTY

Semester	Passages After an Interval of One Day	Number of Students			Median Gain (Percent)
		Gaining	Losing	Equal	
First	B after A	27	15	1	2.35
	C after B	30	19	0	1.65
	A after C	19	19	0	0.00
Second	E after D	11	10	1	0.003
	F after E	8	15	0	−1.15
	D after F	17	4	0	3.63

Relative difficulty of test passages.—The comparative difficulty of the different test passages was investigated to discover whether one can by mere inspection choose several passages of nearly enough equal difficulty to be used interchangeably. On this point the data of Table III are presented.

Additional data from about nine students who wrote tests the second semester in the above order, but with another test intervening, does not affect results except to reduce the median percent gain from 3.63 in one instance to 3.1.

It has already been shown that practice effect accounts for an improvement of about 1.35 percent. With this in mind one may note in Table II that the improvement from Passage A to Passage B was 2.35 percent; that from Passage B to Passage C it was 1.65 percent; and that from Passage C to Passage A there was no improvement at all. If the difficulty of Passage A is rep-

resented by 100, the difficulty of Passages B and C may be represented approximately by 99. and 98.7, respectively. Results for the second semester do not check as closely. Representing Passage D by 100, Passage E is about 100.5, and Passage F about 102. From these studies it seems within reason to conclude that a person can without experiment select prose passages which differ in difficulty by not more than two or three percent and that by trial on a group of 50 to 75 students he can standardize the difficulty of these passages within one to two percent.

While the method of testing above described is in no wise assumed to possess finality, all instructors in typing in University High School have based their final grades in the subject almost solely on the results it has given, and have substituted it to a large extent for the final examination.

Summary

The plan herein described seeks to measure typing efficiency by class performance as well as by individual attainments. It gauges speed by strokes rather than by words. It rates accuracy by a system aiming to discriminate degrees of error, instead of considering all errors equally serious. It emphasizes a fairly high degree of accuracy more than speed, on the assumption, which is believed to be sustained by experience, that speed is a factor naturally increasing with practice, but that accuracy tends to decrease unless placed at a heavy premium.

Results secured by administering tests widely and grading them on this plan are utilized to set up general norms of attainment for varying amounts of practice. A simple rule for transforming absolute ratings into percent ratings is explained.

Data is presented to show the advisability of three short tests on consecutive days, in order to do the individual student justice. This is due to variations in the nervous condition of the student from day to day, and not to any marked extent to practice effects of the tests themselves. Practice effects are small the first semester, and almost negligible the second semester.

Passages chosen with the exercise of only ordinary care as to equality of difficulty are found to vary but 2 percent or 3 percent in difficulty under actual use. It should, therefore, be possible for any teacher to measure closely with material of his own selection the achievement of his classes from year to year.

Editorials

MENTAL HYGIENE AND THE SCHOOLS

We often define education as the process of making changes in human beings. The central problem of educational psychology concerns the determination of what changes can be made in human beings and by what methods. It has long seemed to me one of the anomalies of our profession that, although nearly every educational philosopher puts the formation of character first and the imparting of skills and information second in the desiderata of educational training, our technique of teaching is concerned almost entirely with recipes for learning facts and forming various motor habits. During the last few years, however, a new interest and a new effort with respect to one aspect of character training, namely, the correction of incipient faults of personality has been displayed. This movement for a better understanding of the importance of mental hygiene has been pushed vigorously. Special stress has been laid by most writers upon the prime necessity of an early detection of these defects of personality, because it is felt that it is precisely in these early stages of their development that faults may be successfully corrected which, if left uncorrected, will lead subsequently to serious distortions of mental attitude.

This movement is of a character and importance that commands the respectful attention, not only of all applied psychologists, but also of all classroom teachers. The question I wish to raise is not whether mental hygiene should be understood by teachers and school administrators, but rather just what specific instruction in its practise is now available for those who are willing and even anxious to undertake this practise. The point is that those who want to apply remedial measures for the correction of intellectual deficiencies, like difficulty in learning to read or to spell or to write or to remember names, can find

plenty of concrete suggestions to aid them in this work, but those who want to apply remedial measures for the correction of personality deficiencies, like timidity or sullenness or dishonesty or bullying or tactlessness, can not find suitable concrete suggestions to aid them in that work. At least, if such suggestions can be produced, they have not been made generally available to the teaching profession.

As a matter of fact, a prominent mental hygienist, to whom this dilemma—the insistence on the desirability of doing this work and the lack of adequate instructions as to how to do it—was presented recently, told me that it was not expected that teachers should be able to remedy personality defects. "The correction of these defects," he added, "requires a high degree of expertness, long experience with human nature, and a prolonged study of each case. No one but an expert psychiatrist should be entrusted with the task. The agitation for mental hygiene of which you speak has been furthered simply to interest the general public and to get cases referred to experts at an early stage of their development."

On the other hand, I am informed that in certain sections of the country, persons who would hardly claim to rank as "expert psychiatrists" are already being employed in public-school systems for the express purpose of correcting personality faults in the pupils, and that the school administrators who are employing these persons are enthusiastic over their work. Some thirty "visiting teachers," for example, partially subsidized by the Commonwealth Fund, are now at work in as many city school systems on assignments which appear to be primarily along the lines of mental hygiene for school children.

In view of this situation, I would suggest that it is now time to arrive at a more definite understanding of the relation between mental hygiene and the schools. If my psychiatrical friend is correct, then let the dangers of permitting the inexpert to try to "make over" human beings be made clear; if, however, the enthusiastic school administrators are right, then let the technique of the practical mental hygienist be made more explicit

and generally available. More particularly, I would suggest that there be published a series of "case studies" in which there would be summarized—let us say for ten timid pupils, and for ten bullies, and so on—an account of the symptoms exhibited, the conditions revealed by examination, the remedies prescribed, and the results obtained. If the cases were reported carefully, with frankness when complete failure or a "relapse" chanced to be the outcome, I feel sure the cause of the mental hygienists would be measurably advanced.

G. M. W.

CENTRAL CURRICULUM AGENCIES

No school system is so mean nowadays that it does not have its curriculum committees. The curriculum moves in the full glare of the limelight. Thousands of teachers are voluntarily devoting tens of thousands of hours to the problem of curriculum reconstruction.

This activity is productive of good because it leads the teachers to examine their objectives. It is an excellent pedagogical stimulant which freshens experience and adds zest to the admirable task of teaching, but the curriculum is not greatly helped. The work done on this voluntary basis often without guidance is largely superficial, as it must be. The teachers have neither the time nor the technique to make fundamental studies. Indeed nobody has complete command of this technique; it is just now being constructed.

A few outstanding serious studies are being made in the cities of the nation—notably the Denver study—and in every such case comfortable sums of money for expert direction and for substitute teachers to relieve the workers have been appropriated by the board of education.

The next step is now in order. We should have central curriculum agencies composed of experts who will collect the raw materials for the curriculum by the use of the best technique of curriculum construction.

We can imagine an assignment of the following kinds made by a school system, "We believe that good citizenship should be the aim of education; collect the raw material of such a curriculum for us." Or, another school system might say, "We wish to have a curriculum for stenographers; find out for us what they need to know." The objective having been set, the technician can do the rest of the raw-material collection.

The collection of raw material is a purely technical task and a highly technical one. It can not be done by voluntary associations of teachers. It is a full-time task. Once the raw materials have been collected and thrown into roughly organized form, then the teachers are not only invaluable but indispensable. They can perfect the organization into teaching units or initiate the organization, but up to that point the collection of raw materials is a laboratory job.

Of such central agencies there should be not too many, no more than can be properly manned, and all such agencies should unite to work out plans to avoid duplication beyond the point necessary for verification of each other's work. Such agencies should be adequately supported. State support of curriculum construction is logical, but difficult at present to obtain. Private support should be enlisted. Small appropriations from a number of local school boards would yield in the aggregate enough funds to yield results. If fifty school boards in fifty cities would contribute two thousand dollars apiece to such an agency annually, the results would be much greater than if the same cities each spent ten thousand apiece on independent projects. Amazing results could be obtained from the expenditure of one hundred or of fifty thousand a year for a number of years. The central agencies could gather the raw material of the curriculum and organize it into rough form. The teachers of the cities could complete the task.

Only by some such plan can the efforts of voluntary part-time committees, which are now largely wasted, be turned to efficient use.

W. W. C.

Reviews and Abstracts

MORT, PAUL R. *The Measurement of Educational Need. A Basis for Distributing of State Aid.* New York, Teachers College, Columbia University, 1924. 84 pp. (Teachers College, Columbia University, Contributions to Education, No. 150).

Next to the ever-present problem of how to secure more revenues to meet the constantly increasing needs of the schools, the problem of equalizing educational opportunity is probably the most urgent in school finance today. Glaring educational inequalities among states, counties, and cities have been pointed out many, many times of recent years. These inequalities—inequalities in qualifications of teachers, length of school term, curricula, supervision, buildings, and what not, exist everywhere, as everyone knows who has made merely a casual examination of schools in different communities.

The efficiency of a school system is determined primarily by one or both of two factors, the ability to support the system and the willingness to support it. Measured by the usual standards of school efficiency the less wealthy communities do not have as good schools as the more wealthy ones. Of course, there are many exceptions to the rule, for many communities, although they are able to support good schools, are not willing to do so, and many other communities, although poor, make large sacrifices in order that their schools may be maintained at a high standard of efficiency.

It has been recognized for many years that more aid must be given the weak school districts if they are to meet the increasingly numerous and rigid standards placed upon them by the state. For the state to require certain educational standards of a weak community and then not help the community to finance these standards is manifestly incongruous. Realizing this, all states have provided state school funds designed to equalize educational opportunity. The tendency in both theory and practice is to increase these funds.

Unquestionably this tendency to have larger state school funds would be accelerated were there developed more scientific bases upon which the funds might be distributed. As far as is known no state has a system of distribution that is thoroughly scientific and that is based on need, ability, and effort as it ought to be. Legislatures will tend to be slightly parsimonious with state funds until a thoroughly scientific plan is worked out. The derivation of such a plan is an immediate problem for educational statesmanship in every state.

Research looking toward the derivation of a scientific basis or bases of distributing state aid is much needed. A recent study, therefore, on this general problem is of timely interest. In the language of the author, "the

study seeks to develop a technique for deriving a measure of the educational need of the component parts of a state." In another place he says,

> The educational need of a community is regarded as the composite of all of those elements in the community that would affect the cost of the public educational offering demanded by a state program for making available to all children a satisfactory minimum educational opportunity.

The author sets up standards for measuring educational need, derives his formulas, then applies his standards according to his formulas to the schools of the state of New York.

The study is chiefly a statistical one, much space being devoted to the development of formulas. The statistics are unfortunately so "high-brow" that likely very few people will be able to use them. This statement may be taken as a compliment to the author's knowledge of statistics, but it must also be accepted as a criticism, for there is no reason why the results of research cannot be made intelligible to a larger number of people.

The greatest defect of the study is its lack of clarity. The writing is bad, very bad. Poor choice of words abounds, and the sentences are very involved.

Although it is a major attempt—and the best attempt so far—to place the distribution of state aid on a scientific basis it will not gain wide acceptance because, first, general agreement will not be found for the author's hypotheses; second, its lack of clarity will tend to keep people from reading it; third, the statistics are too "high-brow" for anyone, except an expert statistician, to wade through.

WARD G. REEDER

Ohio State University

BOBBITT, FRANKLIN. *How to Make a Curriculum.* New York, Houghton Mifflin Company, 1924. 286 pp.

Professor Bobbitt's book is a contribution to the technique of curriculum construction. It presents in considerable detail the story of the application of his technique to the high-school curriculum of Los Angeles. An earlier, but less detailed, report was made in a recent number of the "Supplementary Educational Monographs."

Professor Bobbitt's plan of re-constructing a curriculum begins with the school subjects. Assuming that they are to be taught he proceeds to apply certain objectives to each and then determines what modifications of content should be made as logical derivatives of these. The objectives are obtained by selection from a list of over six hundred possible objectives which he collected over a period of several years. The teachers' committees for each subject select from this list those which apply particularly to their field, and add such others as they may decide. The activities and experiences of the pupils are likewise listed, and a combination of these and the objectives are applied to the subject. As a result there are obtained from each subject lists of: (1) objectives, (2) guiding principles and assumptions, and (3) pupils' activities and experiences which have a bearing on the subject. This has been done for thirteen groups of subjects which fairly well cover the high-school field.

The description of the method unfortunately ceases at this point, probably because the work is not yet completed. The technique of the committees in applying the objectives, the assumptions, and pupil experiences to the reorganization of the subjects is crucial. This is a technique in importance equal to that of the steps reported, for without such a technique the study would not be certain to influence the curriculum. We may hope, therefore, to receive the description of this final half of the process at the appropriate time.

To the high-school teacher the book is invaluable. It sets forth in greater detail than is found elsewhere considerations in teaching which will give him a new perspective of his teaching job.

W. W. CHARTERS

University of Pittsburgh

THOMAS-TINDAL, EMMA V., and MYERS, JESSIE DU VAL. *Junior High-School Life.* New York, Macmillan Company, 1924. 287 pp.

We have in *Junior High-School Life* the second appearance in print of a description of practices in the Holmes Junior High School in Philadelphia. The first by Lyman, an article in the February, 1924, issue of the *School Review*, was necessarily brief. This volume extending through almost three hundred pages, affords description in detail of much that in the shorter treatment could only be hinted at—if touched upon at all. On the positive side it may be said that the book is a comprehensive description of what is actually going forward in one junior high school "in the flesh," rather than merely the opinion of some person as to what should characterize pupil activities in such schools. After a preliminary chapter on "Democracy and Education" there are a number—nine in fact—whose titles include the word "guidance": Guidance, Physical Guidance, Curricular Guidance, Social Guidance, Vocational Guidance, Civic Guidance, Avocational Guidance, Ethical Guidance, and Guidance Through Grade Forums. Besides these, there are chapters on "Scholastic Reinforcement," "Student Participation in School Government," "Type Lessons for Grade Forums," "School Clubs," and "Intracurricular Activities." The grade forum is "a democratic assembling of all the students of a particular grade for the common purpose of working out definite educational projects or problems, . . . an effective means of counterbalancing any loss which pupils may have entailed through grading by ability." The intracurricular activities appear to be *extra*-curricular activities ligitimized by including them in the daily schedule and having them supervised by the teaching staff in the related departments. Almost all chapters are replete with concrete illustration as to how pupil-life is going forward.

The critical reader is likely to deplore a persistent and confusing use of the term "guidance." In the broad sense in which the word is applied, it is essentially another synonym for or definition of "education." "Guidance," say the authors, "is the conscious attempt . . . . to direct the activities of pupils toward definite worthy objectives," and the descriptions of most of the types of guidance named above are in harmony with this statement. Guidance in this broader sense can be no more distinctive of the junior high school than of the kindergarten or of the college. The objection to using the word in

this manner is the danger of losing sight of the extremely important special purpose of *guidance in the more restricted sense*—a purpose more or less distinctive of secondary education. Although guidance proper appears not to be neglected in the authors' school, it is not at all certain that others who will follow the dominant note of the volume without question might not fail to emphasize it.

The volume is destined to be genuinely helpful to those who work in an administrative capacity or who are teachers in junior high schools, because it reports briefly and concretely a wide variety of pupil-activities which have qualified on the crucible test of experience.

LEONARD V. KOOS

University of Minnesota

HALL-QUEST, ALFRED L. *Supervised Study in the Elementary School.* New York, Macmillan Company, 1924. 473 pp.

Supervised study as a movement to improve the technique of teaching and learning has been restricted largely to the secondary school. For some time, however, a feeling sympathetic to its extension downward into the elementary school and upward into the junior college has been growing. Those who believe with Professor Hall-Quest that "the aim of work in the classroom is to produce an individual who can economically and effectively direct himself as a learner" will welcome his recent volume which attempts to apply the theory and procedure of supervised study in the elementary school.

The volume consists of two parts and a total of twenty-one chapters. The first part deals with the general principles pertaining to the administration and supervision of study. The author assumes an acceptance of the theses that knowledge of subject-matter is of less importance to a student than the consciousness of possessing mind power, and that the chief aim of teaching is the development of an individual who knows how to use his mind. The various types of supervised study are discussed in the light of the nature of the responses sought, and valuable suggestions are given to teachers for directive teaching. The third chapter deals concretely with the adaptation of the supervised-study technique to individual differences. The view is presented that,

> It is not enough to know that individual differences exist and to be acquainted with the nature of them. A well-developed and comprehensive program of supervised study must include as far as feasible a diagnosis of each child's individuality, especially where certain peculiarities and symptoms indicate serious causes of deficiency or abnormality. A knowledge of the child's heredity and social environment is clearly a prime essential in a well-directed and successful scheme of development. To be able to classify pupils according to their different traits and then to treat them as a physician does a well-understood case is basic to an effectively working scheme of supervised study.

Part II presents the application of the technique of supervised study to the various elementary-school subjects. For convenience in discussion, the subjects are arranged in five groups, namely, the language group; arithmetic; social subjects such as geography, nature study, history and civics; and the

special subjects of music, drawing; and the industrial arts. Reports of actual classroom procedures, details of technique, and a discussion of the specific difficulties to be overcome in the different subjects and types of supervised study are presented with pedagogical thoroughness.

The book should be welcomed by classroom teachers, particularly in elementary schools, and by supervisors who are responsible for the character of instruction below the high school. It may be safely predicted that the volume will exercise an important influence in the improvement of learning and teaching in all the divisions of our public-school system.

W. C. REAVIS

School of Education, University of Chicago

CLARK, JANET H. *Lighting in Relation to Public Health.* Baltimore, Maryland, Williams & Wilkins Company, 1924. 185 pp.

Judging by mistakes made in some of the recently built school plants, school men and architects could very well inform themselves upon the research accomplished in illumination.

This book presents in a non-technical way the results of research in illumination and modern standards of lighting. The publication meets a distinct need, since practically all other discussions of the subject have been from the illuminating engineer's point of view.

Dr. Clark has written particularly for public-health workers, but school men can derive considerable profit from reading the book. Every teacher and administrator should be familiar with the data which are presented in the chapters devoted to "Lighting of Schools" and "Eye-Diseases Due to Low Illumination."

Some of the interesting topics discussed by the author are: units and standards of illumination, how to measure light, the efficiency of different reflectors and types of fixtures, research on eye-fatigue and illumination, lighting of schools, factory lighting, eye-diseases from low illumination, and pathological effects of rodient energy on the eye.

P. R. STEVENSON

Ohio State University

NEW YORK STATE COMMISSION ON VENTILATION. *Report of the New York State Commission on Ventilation.* New York, E. P. Dutton & Company, 1923. 620 pp.

This report describes a large number of extensive experiments and demonstrations in reference to the important matter of ventilation, especially of schools and of public auditoriums. The Ventilation Commission was appointed by the government and composed of the following members: Charles-Edward A. Winslow, Dwight B. Kimball, Frederick S. Lee, James A. Miller, Earle B. Phelps, and Edward L. Thorndike.

Each member of the Commission in his own field carried on extensive experiments. At the outset it was determined that there were at least "four atmospheric conditions to which unfavorable physiological influence may be

attributed, namely, high temperature alone or combined with high humidity, chemical effluvia of various sorts resulting from human occupancy, drafts or exposures to cold air, and unduly low humidity." The experiments required extensive and costly apparatus. The following phases of the question were extensively investigated: (1) the effect on bodily temperature, (2) the circulation of the blood, (3) respiration and metabolism, (4) physical work, (5) the psychological reactions, (6) effects on nervousness and neuro-muscular achievement, (7) condition of the upper respiratory tracts, (8) effects on nasal mucosa, (19) effect on immunity against infection, and (10) the results obtained from different methods of schoolroom ventilation.

The conclusions of early investigators, that the foremost condition to be avoided in regulating the atmosphere of a room is an excessively high temperature, was confirmed by the Commission. A considerable decrease in the amount of physical work performed was shown as temperature increase.

Differences in atmospheric conditions with the exception of overheating, seem to have little or no effect upon mental efficiency when measured by different types of mental tasks. In respect to this important phase in the investigation, the Commission says:

> When a person does less mental work or does the work less well in hot, stale, stagnant air, the cause might be (1) that the strength of the neural connections by whose action mental products are produced was weakened; (2) that, their strength being unimpaired, they were, by changes within themselves less ready to act; or (3) that, though no intrinsic change in them had occurred, the person responded to the discomforts of a hot skin, flushed face, sticky body, and the like, by relaxing or intermitting mental work. In the first case, the person could not think or act as well in bad as in good air if he would. In the second case, he could think as well, but would gain in comfort if he relaxed or intermitted the unsatisfying activity, more in bad air and less in good air. In the third case he could think as well, and would be less comfortable if he did maintain mental activity as much in bad air as in good air . . . . The custom of relaxing mental work in hot temperatures is not then a proof that such relaxation is necessary or wise, nor is it irreconcilable with our experimental results.

The harmful influence of unduly low humidity emphasized by early writers was not, on the other hand, apparent in the Commission's investigation. The results in regard to the influence of the chemical condition of the vitiated air were generally negative.

Different types of school ventilation were investigated including studies on air-distribution in schools, the effect of washing and humidification of air upon health, comfort, and efficiency, ventilation by the use of re-circulated air, and window-ventilation versus fan-ventilation. Careful investigation showed that these factors were only of secondary importance. The Commission concludes, "Finally it must be emphasized . . . . that the avoidance of overheating is the primary essential in all systems of ventilation. Air change, direction of flow, and all other factors are secondary. The most important article of ventilating equipment is the thermometer and however simple or however complex an apparatus may be installed for air conditioning, a constant and intelligent vigilance in regard to operation and overheating is the price of health and comfort."

The Commission has made an exceedingly valuable contribution to the study of school ventilation. The report should be of particular interest to superintendents of schools, business managers, and architects.

P. R. STEVENSON

Ohio State University

HORN, JOHN L. *The Education of Exceptional Children.* New York, Century Company, 1924. 377 pp.

This is a good book for anyone to read who wishes to know what is being done by our city schools for the education of exceptional children. The author defines exceptional children as those who ought not, or who in spite of supplementary assistance cannot be educated with the typical group. He distinguishes seven classes of such exceptional children: the supertypical with I.Q.'s from 113 to 124 inclusive; the subtypical with I.Q.'s from 77 to 88 inclusive; the truants and incorrigibles; the speech defectives; the deaf; the blind; and the crippled. He maintains that the local school system should provide separate classes with differentiated curricula for each of these groups, with the possible exceptions of the blind, whose education is perhaps best undertaken in state schools. He devotes a chapter to each group, and outlines briefly the leading characteristics of such education.

The writer argues that juvenile prodigies—perhaps those with an I.Q. of 125 or over; which he estimates as the uppermost 3 percent—can not be properly educated in the public schools, not even in special classes. Children with an I.Q. of 76 or less, which likewise he estimates at 3 percent, he says belong, not in the public schools, but in the state institutions. What is to become of these children since only a very small percentage of them can be accommodated in our state schools, he does not say. Presumably Dr. Horn would argue that we must build ten times as many, or as large, state institutions for the feeble-minded—for we would need to do that, and more—if we were to take care in them of the dullest 3 percent of the children in this country.

The chief original data in the book consist of a number of tables concerning separate classes for exceptional children in 68 cities and some estimates on the range of age, period of greatest frequency, and the intelligence status of truants. The percentage of speech-defect cures, from two cities are also reported. They range from 20 to 90, according to the nature of the defect.

The book makes a strong plea for greater provision of special education for the crippled. With respect to the deaf, the writer emphasizes as the most immediate problem that of devising a diagnostic test which will facilitate decisions regarding the aptitude of a child for the oral, or lip-reading, method; and as regards both the blind and the deaf, he sees a great need for "a highly satisfactory method of determining intelligence."

HERBERT WOODROW

University of Minnesota

News Items and Communications

This department will contain news items regarding research workers and their activities. It will also serve as a clearing house for more formal communications on similar topics, preferably of not more than five hundred words. These communications will be printed over the signatures of the authors. Address all correspondence concerning this department to Doctor E. J. Ashbaugh, Ohio State University, Columbus, Ohio.

The New Jersey law of 1920 provides that no inquiry shall be made in regard to the religious belief of any person proposed for or seeking employment as a teacher in the public-school system of that state; and that any person who violates any provision of the act shall be guilty of a misdemeanor.

Character Building is the title of a bulletin by the Buffalo, New York, department of education, and is the work of a committee of principals and teachers. It attempts to show what is being done in the elementary school to foster character building and citizenship.

Dr. J. Carleton Bell, for a number of years director of the Maxwell Training School for Teachers, Brooklyn, is now assistant professor of education in the College of the City of New York. In his new position he will give the major portion of his time to the training of teachers for high-school work.

The Board of Trustees of Lehigh University organized an Institute of Research this past year. The functions of the Institute as designated by the Board are as follows: The training of men for research work, the publication of the results of investigation, the conducting of general research and cooperative research, and the giving of commercial tests and advisory service.

The Department of Research of the Cuyahoga County, Ohio, public schools gave achievement tests in algebra, English, composition, Latin, reading, arithmetic, language, and spelling last year. The summary of the results shows that the intensive supervision of instruction which has been going on in that system for the past twelve years has had most beneficial results.

In 1923 the New Jersey tax dollar was spent as follows:

Municipal government	38.6 cents
Education, state and local	31.8 cents
County government	17.0 cents
State government	12.6 cents

Of the school proportion, 57.3 cents was spent for salaries and expenses of teachers; 12.6 cents, for operation and maintenance of plant; 11.6 cents, for

debt service; and the remainder, for the various other items of school expenditure.

Financing of Public School Education in Colorado is the title of the University of Colorado Bulletin (Vol. 24, No. 6), written by Don C. Sowers, executive secretary of the Bureau of Business and Governmental Research. The volume covers the growth of school costs, Colorado's relative educational position, Colorado's financial ability to support education, public-school revenues, Colorado's public-school fund, and taxation and school finance.

The report of the survey of the public schools of Mt. Vernon, New York, directed by the Institute of Public Service presents in an illuminating way the significant features of that school system together with needed improvement and definite recommendations. Any school superintendent will here find material which he can use in an evaluation of his own system.

Bulletin No. 73 by the State Department of Public Instruction, Indiana, is devoted to the *County School System: How Organized and Administered*. Indiana does not have the county school unit except for supervisory purposes. The bulletin attempts to present the advantages of the county unit by comparing Indiana with other states which have it.

A recent Boston University bulletin (Vol. XIII, No. 24), contains an address on "Supervision of Religious Education Through Objective Tests and Measurements" by Dr. Whittier L. Hanson of that institution. Dr. Hanson clearly and forcefully presents the possibilities of the use of the same types of instruments which have been developed for public-school purposes in checking the efficiency and developing the work of religious education.

The Department of Attendance and Research at Warren, Ohio, has issued two extensive mimeographed reports on the work of the school year 1923-24. The first bulletin covers the subjects of attendance, time allotment, distribution of teachers' marks, and the mental and educational tests which were being used. The second bulletin covers the same general field for the second semester. It is evident that child-accounting is receiving a great deal of attention in this school system.

The general report of the Classical Investigation which contains a summary of results with recommendations for the organization of courses in secondary Latin and for the improvement in methods of teaching has recently been issued by Princeton University Press. Whatever may be one's attitude toward the classics and this investigation, the report will be welcome as a means of ascertaining the results. We may expect to find in current literature a critical examination of this volume.

Mr. Carleton R. Hopkins, supervising principal of one of the junior high schools in Camden, New Jersey, has gathered data on retention and retarda-

tion. Among his findings are: (1) New teachers always mark harder and fail more pupils than experienced teachers. (2) Of the 106 pupils who skipped grades, all have made good with but one exception. These children usually lead the class into which they have been doubly promoted. The percent of failure, both by grades and subject, are higher for the term ending in January than that ending in June.

United States Bureau of Education Bulletin, 1924, No. 5, entitled *The Chief State School Official*, is written by Dr. W. G. Reeder, of Ohio State University. The bulletin presents in brief form the results of a thorough investigation of the evolution of the office, qualifications, method of selecting the incumbent of the office, term, salary, relation to state board, powers and duties, and size of staff. Students of this phase of the educational problem will find this bulletin especially valuable.

The Wisconsin State Department of Public Instruction has compiled a series of twenty-two general science tests. The following eleven subjects are each covered by a true-false and a multiple-answer test: heavenly bodies, atmosphere, water, rocks and soils, bacteria and disease, foods, animals and plants, machines and work, sound and light, heat, electricity, and magnetism. Each test consists of twenty questions which can be answered by the insertion of a single digit in the blank space at the left. The material is being distributed by the Eau Claire Book and Stationery Company, Madison, Wisconsin.

The Bureau of School Service and Research, University of Kansas, has published a survey report of the school system of Chanute, Kansas, made by F. P. O'Brien and H. P. Smith of the University of Kansas, C. V. Williams of the State Agricultural College, and H. G. Lull of the State Teachers College at Emporia. The report covers the same general fields usually presented in a survey report. In certain fields, however, more extensive analysis and suggestion will be found than is frequently the case.

"I will study and get ready and then perhaps my time will come" is the title of a little booklet printed in the high-school print shop and published by the Public School League, the Presidents' Council, and the Parent-Teacher Associations of the public schools of Dubuque, Iowa. It is intended to give every boy and girl in Dubuque County a glimpse of the wonderful opportunity offered them in the junior and senior high schools of that city. The booklet is well printed and finely illustrated with photographs of the genuine types of activity conducted by the schools.

Dr. Fred C. Ayer, director of Department of Research, Seattle, Washington, has brought together certain of the significant studies which he has been issuing in mimeographed form, into a single bulletin, now printed under the caption of *"Studies in Administrative Research"* (Bulletin No. 1, June 1, 1924). Those who have received these mimeographed bulletins or who are acquainted with the splendid work on time-allotment which was reported in

the *Second Yearbook of the Department of Superintendence* last February, will appreciate having all four studies under a single cover.

Teachers' Retirement Allowances is the title of the recent National Educational Association Research Bulletin (Vol. II, No. 3). Twenty-two states have state-wide retirement laws; nine have laws effecting cities of the first and second class; while seventeen have no laws of this type. Nine of these seventeen, however, have one or more local units which have a retirement system. In general, the south has no state system, Virginia, Missouri, and Louisiana being exceptions; likewise, in general, the north has some form of retirement system in operation, with New Hampshire, Nebraska, South Dakota, Wyoming, and Idaho the exceptions.

Professor W. S. Guiler of Miami University, Oxford, Ohio, has copyrighted a mimeographed volume on "Teaching Arithmetic through Games and Other Pupil Activity." The volume sets up in Part I definite educational objectives in arithmetic for each of the eight grades; and in Part II presents a series of activities which may be used in attaining these objectives in each of the grades. Many of these activities are not only listed, but the detailed procedure and the statement of equipment are also given. The volume should be of interest and assistance to teachers who are endeavoring to motivate their classroom work through pupil activity.

Outlines in Extra-Curricular Activities is the title of a bulletin by Charles F. Allen, principal of the West Side Junior High School, Little Rock, Arkansas, and published by the high-school print shop of that city. The reports that appear are the products of the students in a class of extra-curricular activities offered as extension work by the University of Arkansas under the instruction of Mr. Allen. Under the various activities are listed, as the title of the bulletin suggests, merely an outline, and yet the outline is so suggestive that high-school principals and teachers who are at all interested in the general problem cannot fail to find help therein.

Mr. Carl Colvin, who was at one time a member of the faculty at the University of Illinois and who still later was associated with the Illinois State Board for Vocational Education, as State Supervisor of Agricultural Education, has lately become Director of Education for the Republic of Haiti. Mr. Colvin is still interested in educational research and is apparently relying upon it in the organization of a system of education in Haiti. It is his intention to introduce standardized tests in the schools under his direction. Since French is the prevailing language of Haiti, however, he is under the necessity of translating and adapting the test materials. He has lately been furnished with a large number of tests from this country in order that he may select from them those most suitable for his purpose.

Many of our readers who face administrative problems connected with mentally deficient and retarded children seldom, if ever, read the proceedings

of psychological associations or such magazines as *Mental Hygiene*. Valuable material, however, may frequently be found in such sources. *Mental Hygiene* for July, 1924, contains an article entitled, "Classification for Instruction of Mentally Deficient and Retarded Children" by Dr. J. E. W. Wallin, of the Bureau of Special Education and Psycho-Educational Clinic, Miami University, Oxford, Ohio. Out of his rich experience with such children, Dr. Wallin sets up a workable program which should be considered by any administrator who attempts to solve this problem.

The *Detroit Educational Bulletin* for October, 1924, contains the report of an experiment concerning the efficiency of the class assignment and the project methods of teaching IX-B English in the Detroit Central High School during the school year 1923. Two classes of the same number and average age with approximately the same proportions of repeating students were the bases for the experiment. The results indicate that the project method resulted in a larger amount of reading by the students, more agreement of students' choices of the good literature with those of the teachers, a greater percentage of accuracy on an objective test, and a larger proportion of the class apparently finding real enjoyment in the subject.

Dr. J. Harold Williams, for several years director of the Whittier State School for Delinquents at Whittier, California, and more recently psychologist with the Los Angeles Diagnostic Clinic, has been appointed director of a newly created educational service Bureau of Teachers College, University of California (Southern Branch). The purpose of the Bureau is to render measurement service to the towns and vicinities of California where fully equipped departments are not established. This Bureau will organize and supervise the measurement work through a committee of principals and teachers appointed by the local superintendent of schools. Dr. Williams also has charge of instruction in educational measurements in the University, a course which is now required of all students completing the teacher-training course.

The school people of the United States generally rejoiced in the action of the last Congress in providing an adequate salary law for the schools of the District of Columbia. For a considerable time the situation has been little less than disgraceful, but the new provision places it in a much more favorable light. Superintendent Ballou states that this is one of the most important legislative enactments effecting the schools of Washington that has ever passed Congress. We are also pleased to know that the board of education of Washington, D. C., adopted the report and the recommendation of the superintendent with relation to the program of educational research which is being carried on in that city. In spite of the criticism which had arisen, the board approves of the work which is being done, and recommends its expansion as rapidly as the resources at the disposal of the board will permit.

A Study of Rural Schools in Runnels County, Texas by J. L. Tennant, research specialist in rural education, and E. E. Davis, of the Austin State Teachers College, gives a comprehensive picture of the school situation. The financial aspects, the school plant, teachers, pupils, community, and trustees are discussed. While much of the work had to be done by questionnaire, it is evident that the report gives us a composite picture of many phases of the rural problem as seen through the teacher's eyes. Most of it was subject to objective criteria, while other parts involve the subjective element with all of its necessary variations. The bulletin will, in general, be of interest to workers in the field of rural education.

"Number Combinations: Their Relative Difficulty and the Frequency of Their Appearance in Textbooks," (University of Wisconsin, Bureau of Educational Research Bulletin, No. 2, July, 1924), is written by F. L. Clapp, assisted by B. P. Huebner, with the advice of V. A. C. Henmon, director of the School of Education. This is one of the most complete analyses of the number combination, methods of presentation, difficulties, errors, etc., that has come to our attention. Perhaps the most significant finding in the entire study is that in every case the correlation between the difficulty of combination and the frequency of its appearance in the two textbooks examined is negative. The coefficient for the two texts and the four operations ranges from —.277 to —.538.

The Bureau of Educational Research at the University of Wisconsin was started last year with a little different plan of organization than that which is found in other institutions. The affairs of the Bureau are directed by a Research Committee of three, consisting of F. L. Clapp, J. G. Fowlkes, and V. A. C. Henmon. A secretary of the Bureau takes care of the correspondence and the distribution of questionnaires and reports. A room is equipped with separate desks for graduate students who are assigned to specific quarters. This bureau proposes to issue three types of publications; first, studies which would be printed monographs; second, bulletins which would be briefer studies also printed; and third, mimeographed reports. In these mimeographed reports, preliminary results will be sent back to those cooperating in any investigation. As will be seen, they are trying the plan of a Research Council rather than a single director.

"Proceedings of the High-School Principals' Conference" held in November, 1923, has appeared as the first number in the first volume of the *Bulletin of the School of Education, Indiana University.* Through this conference the university is endeavoring to throw light on the problems of the high-school principal in the same general manner that it has been lending assistance in the field of tests and measurements through conferences on educational measurements. The high-school schedule; athletics; faculty meetings; auditorium exercises; credit for out-of-school work; determination of curricula content; training, experience, and responsibilities of the high-school principal; and the articulation of the junior and senior high schools are among the subjects discussed.

The Public School Publishing Company has issued a series of fifteen lists giving the technical and difficult words frequently found in textbooks in the following subjects: grammar and composition, English and American literature, arithmetic, geometry and algebra, American history, general science, biology, chemistry, geography, physics, physiology and hygiene, home economics, manual training, art, and music. Certain of these lists are further subdivided. The work has been done under the direction of Mrs. L. C. Pressey of Ohio State University. Each list purports to present the words which pertain particularly to the subject, or are difficult words which are frequently found in textbooks in this field. Words which appear in two or more fields are, at least in part, cross-indexed. The lists are intended as an aid to the teacher in pointing out the words which are of especial importance and which may provide material for review.

Two especially good school-building programs have come to our attention in recent months. One is the *Milwaukee School Building and Sites Program* developed by a committee representing the schools, the board, and certain specific organizations. The other program is *A School-Building Program for Cedar Rapids, Iowa,* prepared by the College of Education and Extension Division, State University of Iowa.

Another less extensive report on the same subject is an *Eight-Year Building Program for the Schools of Cincinnati* submitted to the board of education by the superintendent of schools. Each of these bulletins presents a careful analysis of the school population, the trends of population growth, the present plant, and the future needs. Definite recommendations with specific information for the financing of the program are also presented in each case.

The board of education of Denver is issuing a series of "Course of Study Monographs." Among those which have recently come into our hands are: No. 1, *Kindergarten;* No. 2, *General Science for Grades VII and VIII and Biology for Grade IX;* No. 3, *Social Science for Grades VII, VIII, and IX;* No. 4, *Arithmetic for Elementary School;* No. 5, *Latin for Junior High School;* and No. 6, *Commerce for Junior High School.* These monographs are the work of the department of curriculum revision and a committee especially appointed for this purpose. For each of the special fields they attempt to give definite assistance to the teacher through a statement of aims, presentation of problems, standards of attainment, and specific reference materials. They are full of suggestions and should be both helpful and stimulating without in any way interfering with desirable initiative on the part of the teacher.

Tennessee's State Commissioner of Education, P. L. Harned, has set forth the following educational program:

1. A more economic and business-like county administration
2. An eight-month minimum school term for all counties
3. Repeal of local legislation, large cities excepted
4. Revision of the elementary course of study, reducing the number of subjects to what is physically possible for teacher and pupil

5. Better care of school property, with adequate provisions for replacement and improvement

6. Changes in the requirements for licensing county superintendents and teachers

7. Salary schedule for superintendents and teachers in direct relation to service

8. Uniform promotion of children in all grades, based on examination at the close of term

9. A state school architect for economy and efficiency

10. Change in the method of distributing textbooks to insure a greater saving to the people

11. A system related to the economic needs of the state, and an equal opportunity for all children

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Mr. J. C. Stiers of the schools of Washington, Pennsylvania, evidently believes that one of the best ways to convert teachers to the idea of individual differences is by personal experience. Early this year he gave his teachers a brief reading test during which the teachers were to check their rate of reading at regular intervals, and then designate on the paper their final rate. His conclusions from the test which he sent to the teachers, together with the general results of the test, are worth quoting:

(1) The teachers of Washington confirm the investigations of others by proving the most rapid readers, as a class, are superior content readers. If the first eighth is graded, the grades will prove to be much better than the second eighth or any other eighth, in both speed and content.

(2) The rate of reading of the teachers of Washington is, as a class, very slow.

(3) Definite answers are not found among the slower readers.

(4) Much guess work is exhibited in the answers.

He then proposes the following questions:

Do the teachers permit children to use generalities such as were found in these papers? If a pupil answers vaguely and indefinitely, does his teacher make him look up the exact answer? Is simply grading the pupil poorly without making him search for the true answer developing the best reading habits?

NOTE.—Professor T. J. Kirby has just reported an error which he made in computing the standard error of estimate given in his article, "A Latin Comprehension Test," which appeared in the November issue of the *Journal*. On page 315 the standard error of estimate which is reported as 3.28 should be 2.51. The computations in the next two sentences should be changed as follows: "The probable error of estimate is .6745 of 2.51, or 1.69 score points. That is, the chances are equal that the true score of the pupil who scores 24 on the one form will not go above 25.69 nor below 22.31.